

MODULUS I/O

Hardware Installation Guide

For hardware installation details, an on-line document is available here:

<http://files.iclinks.com/manuals/modulus/release/ModulusFamilyInstallationAndOperation.pdf>

MODULUS DASHBOARD

The I/O module "dashboard" has an upper status line and a row of configuration tabs below it. Each tab supports a unique function of the I/O module, including:

- **Local I/O**
- **Module I/O**
- **Registers (Communications Concentrator)**
- **Communications**
- **Alarming/Notification**
- **HMIs**
- **Programming**
- **Historical Trending**
- **PID and Pump Control ("Special Functions")**
- **System Maintenance and Utilities ("System")**

Status Line

(i) Information Button

This button toggles the display of the help information that you are reading now at the bottom of the screen.

Module Selector Drop Down

This is a pull down selector that lists all of the I/O modules currently on the bus. The configuration pages of any I/O module can be accessed by selecting the modules from the list. It should be noted that the firmware of all units on the bus should be the same firmware revision or the user will be prompted to update the firmware. The latest firmware can be downloaded at <http://www.iclinks.com/Download-RTUs/>.

Status Indicators

These are status indicators for individual sections of the module. The indicators are green for normal operation, yellow for a warning condition and red to indicate a problem. Clicking on an indicator brings up the status page for that section. Statuses are:

LOC I/O (Local I/O Status)

- **Red** - If there is an I/O Alarm of any kind.

- Yellow - If no I/O Alarm is active and I/O forcing is active.
- Green - No I/O issues found.

Clicking on this icon will open the Local I/O | I/O Status tab.

MOD I/O (Bus I/O and Communication Status)

- Not Shown - If no other units are on the Bus.
- Red - If there is a communications failure or configuration error with one or more modules.
- Green - No issues found; Bus is active and other units exist.

Clicking on this icon will open the Module I/O | I/O Status tab.

MCOMM (Master Communications Status)

- Not Shown - If no Master Events are configured.
- Red - If there is a communications failure or configuration error with one or more Destinations.
- Green - No issues found; Destination communication is active.

Clicking on this icon will open the Communications | Master Status tab.

SCOMM (Slave Communications Status)

- Not Shown - If no Slave Communication Timeouts are configured.
- Red - If there is a communications timeout with one or more slave interfaces.
- Green - No issues found; slave communication is active.

Clicking on this icon will open the Communications | Slave Status tab.

PROG (Control Program Status)

- Not Shown - If no program is found.
- Red - This icon lights red if there is a program runtime error or scan timeout.
- Yellow - If there are program warnings but the program is still running.
- Green - Program is running normally.

Clicking on this icon will open the Programming Editor and debug environment.

PUMP (Pump Control System Status)

- Not shown - If no Pump Control configuration was found (no outputs assigned)
- Red - If there was a Pump Control system failure of any kind.
- Green - Pump Control is operating properly.

Clicking on this icon will open the Special Functions | Pump Control tab.

ALARM (Alarm Status)

- Not shown - If all Alarms enabled in the system are Idle (not Active and not in the Acknowledged state) or there are no Alarms enabled.
- Red - If there are any Active Alarms that have not been Acknowledged.
- Yellow - If there are no Active Alarms and there are Acknowledged Alarms.

Clicking on this icon will open the Alarming / Notification | Status tab .

MESH (Mesh Communications Status – Mesh Units Only)

- Not shown - This is not the Mesh firmware version, the Mesh option is not installed or no Mesh configuration is found.
- Red - Communications failure with one or more units.
- Yellow - there are no communication failures but there are one or more conditions currently:
 - Remote unit does not match MESH master configuration.
 - Remote unit is under power failure but still on-line.
 - Remote unit’s firmware is being updated by the Master (this unit).
- Green - All Mesh Communications are good.

Clicking on this icon will open the Mesh I/O | I/O Status tab.

Status Message Display

Just to the right of the Status Indicators is an area that displays the last status message. Clicking on it brings up a display window that shows a history of the last 5 status messages. A much longer history of status messages can be viewed or printed by accessing the System Log (**System | Log** tab)

Table of Contents

MODULUS I/O	1
Hardware Installation Guide	1
MODULUS DASHBOARD.....	1
Status Line.....	1
(i) Information Button	1
Module Selector Drop Down	1
Status Indicators	1
Status Message Display.....	3
Main.....	11
Local I/O	11
I/O Status	11
Digital Inputs	11
Digital Outputs	13
(UI/AI) Analog Inputs	14
Raw Input Settings	14
Engineering Value Settings	15
Alarming.....	15
UI Common Parameters.....	15

Alarm Group En (1-8)	16
Analog Outputs	16
Module I/O.....	17
I/O Status	17
I/O Mapping.....	17
Register Mapping.....	18
Registers.....	19
N Registers	19
B Registers.....	19
N Registers Config.....	20
B Registers Config	20
Import/Export	21
Mappings	22
MESH I/O (mesh communications modules only)	23
I/O Status	23
Statistics	23
Status	23
AlmDis (Alarm Disables).....	24
View	24
Setup	24
Sleep Mode	24
Polling Mode	25
Slave Setup.....	26
Mesh Slave Comm Fail	26
Remote Alarm Group Enables.....	26
I/O Mapping	26
Communications	28
Slave Status.....	28
Master Status.....	28
Ethernet	29
Protocol Configuration.....	31
Ethernet Slave Comm Fail	31

Slave Status	31
Mastering	32
Any master Comm Fail	33
NTP Server Address and NTP Test button.....	33
Bus.....	33
Mode	33
Inter-module Bus Mode (IOX) Operation	33
General.....	33
Bus Slave Comm Fail	33
Module I/O Mastering	34
IOX Slot Comm Fail.....	34
IOX Disables	34
Slave Status	35
IOX Stats	35
RS-485 Bus Mode (non IOX) Operation	35
General.....	36
Bus Slave Comm Fail	36
Modbus Store & Forward	36
Mastering	37
Any Master Comm Fail.....	37
Slave Status	38
Ethernet Bridging	38
Pass-through Bridge Port	38
Com(x)	39
Port Mode	39
General.....	39
Protocol (Enables)	39
Comx Slave Comm Fail	40
Slave Status	40
Modbus Store & Forward	41
Mastering	41
Any Master Comm Fail.....	42

Ethernet Bridging	42
Cellular (cellular communications modules only).....	42
Cellular	43
General.....	44
Cell Slave Comm Fail	45
Protocol.....	46
Mastering.....	46
Any master Comm Fail.....	47
Slave Status	47
Ext. Cell.....	48
Config.....	48
Status	48
E-mail	49
General.....	49
SMTP	49
POP3.....	49
FTP.....	50
FTP Client	50
FTP Server	51
C Drive File Purge	52
MQTT	52
Config.....	54
Publish.....	54
Boolean Verbiage.....	55
Satellite Server	55
Satellite Server (Outgoing To Remote Satellite Modems)	55
Pop3 (Incoming From Remote Satellite Modems).....	55
Routing.....	56
Master Destinations.....	56
Master Events	58
Dynamic DNS (DDNS).....	60
Serial File Transfer.....	60

Modulus Model Information.....	61
C Drive (SD card)	61
Alarming / Notification	62
Status	63
Alarm Grid.....	63
Config.....	63
General.....	63
Alarming.....	64
Daily Alarm Site Check-in	65
Periodic Report	65
String Notification.....	66
All Alarms	66
Contacts	66
Schedule.....	66
Report Editor.....	67
File Access Pull-down Menu	68
Report Storage Selection (in the module)	68
Report Editor Tools	68
Tag Selection Pull-down Lists.....	69
Trend Data in Reports	69
Event Log Data in Reports.....	71
Event Log Data Filters	72
Event Log Filtering.....	72
Images in Reports (.htm reports only)	72
Report Style Tools (.htm reports only).....	73
Document Style Tool.....	73
Tables	74
Table Styling Tool.....	74
Window/Tab Title Tool	75
Text Style Tool.....	75
HMIs.....	75
General.....	75

Graphical HMI	77
Editor Settings, Page Settings, and File Access	77
Graphic HMI Editor Tools	79
Graphic HMI Library	81
Editor Key Combinations	81
Control Editing	81
Common Control Parameters	82
Graphic HMI Library Control Descriptions	84
Mobile HMI	97
Access Links	97
Mobile HMI Page Configuration Area	97
Local HMI	98
Boolean Verbiage	98
Triggers	98
Programming	99
Ladder Logic and Function Block Editor	100
Primary Tools	100
Secondary Tools	101
Program Status Area	102
Program Editing Area	103
Text Logic and Graphic Logic Page Security	103
Tag Selector	103
Programming, Functions, and Function Block Library	104
Trending	104
Viewer	104
Viewer Controls	105
General	106
Config	106
Traces	107
Trace	107
Trend Groups	108
Trace Style	108

Trend Groups	108
Special Functions	108
PID	108
Pump Control	109
Individual Pump Mappings and Status.....	111
Pump Scheme Specific Controls.....	112
Sensor Level Control parameters.....	112
Float Switch Control parameters	113
System.....	113
Info	114
Logs	114
System Log xx% Full	114
System Log Enables.....	114
Event Log xx% Full	115
Alarm Log xx% Full	115
Files	115
B Drive (internal).....	115
C Drive (SD card)	116
C Drive File Purge	117
Security	117
Admin Account (MUST be filled out to enable Security)	117
Accounts.....	117
General.....	118
Ethernet (slave protocol enables).....	119
Bus (slave protocol enables)	119
IOX Disables	119
Comx (slave protocol enables).....	120
Time	120
Current	120
Zone	120
Daylight Savings Time (Auto)	120
Bus.....	121

Satellite	121
Monitor	121
Miscellaneous	122
Utilities	122
Power Saving	124
Input Simulation Tests	124
SD Card Operations	124
Programming	124
I/O Calibration.....	125
Modulus SMS/Email Commands.....	125
Text Command Formatting Rules	125
Table of Text Commands	125
Example Text Messages	127
Tag Names.....	127
Technical Support	127

Main

The MAIN tab displays the values and states of all I/O points and internal registers (numeric and Boolean) that have been marked with a "visible" attribute in their respective configuration sections. As shipped from the factory and when defaults are reset, all local I/O is marked as "visible". Any registers marked with a "writable" attribute will have their values displayed in blue (instead of black). Clicking on the value opens an editing window to enable changing it.

Local I/O

The LOCAL I/O tab provides access to all of the local I/O points with associated totalizer, rate and interval measurements. Configuration information including tag names, inversion, analog modes, forcing, filtering, scaling, formatting, and alarming may also be accessed from this tab.

I/O Status

Each of the local I/O types are listed in separate columns with their tag names, associated values and forcing indicators. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. Spaces should be filled in as underscores and punctuation characters should not be used.

Digital Inputs

Digital Inputs have green "LED" indicators to show their Boolean states. The first eight inputs have built-in 32-bit totalizers as well as rate and interval measurement.

Digital Outputs

Digital Outputs have green "LED" indicators to show their output register states as well as their actual ("relay") output states.

Universal/Analog Inputs (UI/AI)

The Analog/Universal Inputs are displayed as scaled values with both their tag and units information. Universal Inputs are analog inputs with built-in sensor conditioning and linearization.

Analog Outputs

The Analog Outputs are displayed as scaled values with both their tag and units information.

Wiegand

If a DI pair has the capability and the "Wiegand" mode is set, then the number read from the Wiegand device will be displayed in the Wiegand section.

Digital Inputs

The Digital Inputs tab is used to configure the operation of the digital inputs and display their related states and values. The elements shown for each digital input include:

Value

Green "LED" indicators show the digital input Boolean states.

Tag(name)

A tag is user settable name for each input. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is DIx where x is the input number.

Mode (when needed)

DI groups that support the Wiegand protocol have a selector for the mode. If selected in "Wiegand" or "Keypad" mode, the DI with the mode selector and the next DI are now can be connected to a Wiegand card reader or keypad input device. If the DI's in question have totalizers, rates and interval values, they will no longer be displayed. If enabled, a Wiegand value is displayed on this page.

Vis(ible)

Check the box for each input that you wish to have visible in configuration and display lists in other sections. By default, all digital inputs have their visibility check box checked.

Invert

Check this box to invert the state of a digital input. For example, alarms are triggered with a 1 or on state. If an input should generate an alarm when the input turns off, select invert for that input.

Frc (forcing)

Use this column of controls to force the states of individual inputs, regardless of their actual input states. This also can be used to override inputs that have defective or missing sensors. When an input is forced, a yellow block with an "F" is displayed on the I/O status page in the forcing column for that channel, and the "LOC I/O" status indicator at the top of the page turns yellow.

DI Filters

All digital inputs have configurable filtering to mitigate noise and contact bounce. The first eight inputs can be set to "roll off" at 5Hz, 10Hz, 20Hz, 50Hz, 100Hz, 200Hz, 500Hz, 1KHz, or 2KHz +. The remaining inputs have two-state selectors to roll off at 20Hz or 100Hz. The default setting for all filters is 20Hz which works well for most applications with both DC and AC signal inputs.

Alarm Controls

Every digital input can be assigned to one or more alarm groups. Alarm groups are used to route individual alarms to the contacts that should receive them such as security, maintenance, etc. There is also a check box for each input to momentarily disable individual alarms. Alarm disables are non-volatile and will be remembered through a power cycle.

Totalizer, Rate and Interval display

The first eight digital inputs have built-in totalizer, rate measurement and interval measurement. The current values are displayed in their respective columns. The totalizers can be preset by clicking on their value. Totalizers are non-volatile and are remembered though a power cycle.

DI Rate Gate Time (S)

This value is the sampling time used for rate measurements. For example, a value of 60 (default value) means that the number of pulses are counted within a one minute window.

Interval Time Limit(S)

Interval measurements measure the time between leading edge transitions of digital inputs in milliseconds. This value is the limit (clamp) on the interval measurement value if there are no transitions.

Wiegand

If a DI pair has the capability and the "Wiegand" mode is set, then the number read from the Wiegand device will be displayed in the Wiegand section.

Digital Outputs

The Digital Outputs tab is used to configure the operation of the digital outputs and display their related states and values. The elements shown for each digital output include:

Value

Green "LED" indicators show the digital output register Boolean states.

Relay

Green "LED" indicators show the digital output relay (actual) Boolean states.

Tag(name)

Tag is a user settable name for each input. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is DOx where x is the output number.

Frc (forcing)

Use this column of controls to force the state of individual outputs, overriding the state commanded by communications or a logic program. When an output is forced, a yellow block with an "F" is displayed on the I/O status page in the forcing column for that channel and the "LOC I/O" status indicator at the top of the page turns yellow.

Vis(ible)

Check the box for each output that you wish to have visible in configuration and display lists in other sections of the module. By default, all digital outputs have their visibility check box checked.

Recycle Hold off

Some control devices such a motors and pumps can be damaged by turning them on before they have had a chance to come to a complete stop from a previous cycle. This can be avoided by setting the Recycle Hold off that prevents the output from turning on before it is off for a set period of time. This protection also applies after a reset or power cycle.

Comm Fail

This setting determines that output state (hold, off, or on) for individual outputs during a communications failure.

(UI/AI) Analog Inputs

The Analog Inputs tab is used to configure the operation of the analog inputs and display their related values. The elements shown for each analog input include:

Value

The scaled analog reading. Note that if a temperature sensor is selected, the reading is in tenths of a degree by default (unless re-scaled).

Tag(name)

A user settable name for each input. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is AIx where x is the input number.

Units

User settable text of up to 8 characters.

Vis(ible)

Check the box for each input that you wish to have visible in configuration and display lists in other sections of the module. By default, all analog inputs have their visibility check box checked.

AI or UI Mode

This is a selection list that determines the input mode and range for each input. If you change a mode, you will be asked if you want to set the scaling and format settings for the channel to the defaults for that selected mode.

Samp(le)

Select the number of analog samples (readings) that will be averaged together (1, 2, 4 or 8). "Box car" averaging is used so that response time is not slowed by the averaging (average is recalculated with every new sample).

Raw Input Settings

Frc (forcing)

Use this column of controls to force the value of individual inputs, overriding the actual analog readings. When an input is forced, a yellow block with an "F" is displayed on the I/O status page in the forcing column for that channel, and the "LOC I/O" status indicator at the top of the page turns yellow. The forced analog value is in raw analog units; for example uA for current, uV for voltage, ohms for resistance and tenths of a degree for temperature.

Clamp

Check this box for every input that you wish to limit the low or high range of readings. For example, if 4 to 20mA scaling is selected (raw range of 4000 to 20000), the lowest reading will always be 4000 (4 mA) and the highest reading will always be 20000, even if there is no input signal.

Low and High Input Scaling

These two values define the input signal range before scaling. It actually defines two points for a scaling curve since input values outside of this range will be scaled linearly unless clamping is selected (see clamping description above).

Engineering Value Settings

Low and High Engineering Unit Scaling and Format

For the low and high raw input values, the analog reading is scaled to user settable engineering values. If the low and high engineering scaling values are set to 0s, the analog reading is not scaled (left as the raw value). Reverse linear scaling is supported; in other words, an ascending raw scaling range can be set to generate descending scaled engineering values. The Format sets the decimal point position and whether the scaled engineering values are signed or unsigned.

Alarming

Low and High Alarm Setpoints and Hysteresis

High and low alarm setpoints can be set to annunciate alarms if the analog input readings go above or below these alarm thresholds. Once a threshold is exceeded, a new alarm will not be generated unless the input restores back to a non-alarm level by the Hysteresis percentage. When a hysteresis percentage value is entered, the corresponding actual hysteresis levels are displayed in the far right two columns (Hyst High and Hyst Low).

UI Common Parameters

UI Sleep Time (S)

If the UI Sensor Power Enable is mapped, this time will cause the UI sampling to freeze for this amount of time saving loop or sensor power in the process. When this timer elapses, the system will:

- Turn on the UI Sensor Power Enable B Register or DO
- Wait for the UI Warm Up Time (S) (see below)
- Update the UI readings
- Freeze the UI readings again
- Turn the Sensor Power Enable B register or DO back off again

This operation will also be done after a reset or power cycle of the unit.

UI Warm Up Time (S)

Amount of time to wait after the UI Sleep Time (S) has elapsed and turned on the UI Sensor Power Enable B register or DO before taking UI readings.

UI Sensor Power Enable

This allows the mapping of a B register or DO which will control power to a loop or sensor intermittently using the UI Sleep Time (S) parameter.

Run UI/AI in 2X Mode

Allows UI/AI's to be sampled twice as fast.

Alarm Group En (1-8)

Any UI/AI Alarm

If there is a UI or AI Alarm, the module can annunciate the error to one or more alarm groups by checking the appropriate boxes. Individual Alarm Disables for High and Low Alarms are setup with each UI/AI. This alarm group assignment applies to them all.

Display/Calculate in Degrees C

Check this box to show any UI Temperature Modes in Celcius

Analog Outputs

The Analog Outputs tab is used to configure the operation of the analog outputs and display their related values. The elements shown for each analog output include:

Value

The analog output value in uA (4mA = 4000, 20 mA = 20000)

Tag(name)

A tag is a user settable name for each input. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is AOx where x is the output number.

AO Mode

This is a selection list that determines the output range for each output (4mA to 20mA or 0mA to 20mA).

Frc (forcing)

Use this column of controls to force the value of individual outputs overriding the actual analog output settings. When an output is forced, a yellow block with an "F" is displayed on the I/O status page in the forcing column for that channel, and the "LOC I/O" status indicator at the top of the page turns yellow. The forced analog output value is in raw analog units (uA).

Vis(ible)

Check the box for each output that you wish to have visible in configuration and display lists in other sections of the module. By default, all analog outputs have their visibility check box checked.

Comm Fail

This setting determines the analog output values for individual outputs during a communications failure. They can be set to none (leave at last state) or a value in uA (ie 12000 = 12mA, half scale for a 20mA loop).

Module I/O

The MODULE I/O tab provides a simple means of exchanging I/O and register data with other Modulus I/O modules on the bus. Support is provided for up to 32 primary modules and 32 redundant backup modules.

I/O Status

This tab provides an overview of the available I/O modules that share the bus with the current module and allows for selecting redundant alternative modules for systems with automatic failover operation.

Xmit, Receives and Fails Statistics and Clear Button

These are 16-bit counters for bus message transactions with each I/O module. The counts roll over to 0 when they exceed 65535. They can be cleared by clicking on the individual clear buttons.

Disable Checkbox

Checking this box for a module disables communications to it. It is primarily for diagnostic purposes.

AlmDis (Alarm Disable) Checkbox

Checking this box for a module disables generating communications failure alarms for this module.

Primary and Redundant Status

These two columns show the current status of communications with other Modulus modules on the bus. If a Redundant Slave is configured for the module, the Redundant column will show the status of the Redundant Slave unit.

Redundant Slave

This is a selection list to select a redundant backup module. The redundant backup module must be the same model as the primary in the Destination column.

AlmDis (Alarm Disable) Checkbox

Checking this box disables generating communications failure alarms for a redundant backup module.

I/O Mapping

This tab provides a means of "mapping" blocks of I/O points and registers to/from other Modulus modules on the bus with boolean and numeric registers in the local module.

The module to be mapped is chosen from a selection list just under the "I/O Mapping" tab. If the module is on-line, its name will appear in the list and the appropriate I/O configuration will be displayed below in four groups; Discrete Inputs and Outputs, and Analog Inputs and Outputs. If a module is not on-

line at the time, the module name will be listed as a generic "Slot x" and the type of module must then be chosen from the selection list just to the right.

Remote Tag

If the remote unit is on-line, this column contains the tag names of the remote unit's points and those tags can be renamed and transmitted to the remote unit. If the unit is not on-line then the default tag names are used.

Copy << >>

When the remote unit is on-line, this column has left and right arrow buttons for each I/O point. Clicking on a **left** arrow key copies the tag name from the mapped register to the tag name in the "Remote Tag" column and writes it to the remote unit. Clicking on a **right** arrow key copies the tag name from the remote unit "Remote Tag" column to the mapped register.

Val

Val shows the current value of the I/O point as soon as it is "mapped" to an internal register. Digital inputs and outputs are displayed as a boolean "LED". Analog values are displayed as numbers.

Map

This column has selection lists of boolean and numeric registers to which remote I/O points are "mapped". This functionality is for mapping one register at a time.

Select and Multiple Point Mapping and Un-mapping

The Select column has individual checkboxes for each type of data (analog in/out and digital in/out). The boxes are checked in order to map multiple registers at a time. Clicking on the Select All button at the bottom of a data type group checks all of the boxes. Likewise, Uncheck All un-checks all of those boxes. To map a block of remote I/O points all at one time, select the registers that you want to map them to. Then select the starting internal register for the top-most register selected. Click on the "Map" button. The selected I/O points will be mapped to sequential registers starting with the first one that you selected. Likewise, selecting one or more mapped registers and clicking on the "Unmap" map button will unmap multiple remote I/O points at one time.

Register Mapping

This tab provides a means of "mapping" blocks of registers, as well as I/O points to and from other Modulus modules on the bus to and from boolean and numeric registers in the local module.

Tag(name)

A user settable name for each block transfer between I/O modules. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character.

Destination

The module to be mapped is chosen from a selection list just under the "Destination" tab. If the module is on-line, its name will appear in the list. If a slot's module is not on-line at the time, the module name will be listed as a generic "Slot(X)".

Poll

The checkboxes in this column should be checked to cause the local module to continually update the register data from the remote module. If unchecked, the data transfers may be initiated from the programming environment.

Message Type

This column has selection lists with every possibly type of message supported.

Local, Remote, and Block Size

The local and remote column should be set to the starting registers to be transferred between the local and remote I/O module. The number of registers to be transferred must be entered in the right-hand column.

Registers

The Registers tab provides a means to configure all 504 boolean and 504 numeric registers with tag names, attributes and formatting. Any Modulus module can serve as a data concentrator. In these cases, numeric data is collected into N registers and Boolean bit data is gathered into B registers.

N Registers

The N registers tab displays all numeric registers that have been marked as "visible". Registers that have been marked as "writable" may also have their values changed here. The visible and writable attributes are set on the "N Registers Config" tab.

Value

The current value in the displayed register updates in real time. Values displayed in blue are writable and may be changed by clicking on them.

Tag(name)

Tag is a configurable name for each register. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is Nx where x is the register number.

Units

An optional text descriptor of up to 8 characters.

B Registers

The B registers tab displays all Boolean registers that have been marked as "visible". The register states are shown as green "LED" indicators in the "Value" column. Registers that have been marked as "writable" may also have their states changed by clicking on the indicators. The visible and writable attributes are set on the "B Registers Config" tab.

N Registers Config

The N registers Config tab facilitates configuration of the numeric registers; setting tag names, units descriptions, attributes and formatting each register. An register may be defined as a signed or unsigned 16-bit integer, 32-bit integer or floating point value. N registers are natively 16-bit, therefore when a 32-bit or floating point format is selected, two 16-bit registers are combined and handled as a single entity throughout the rest of the module's sections.

Value

The current value in the displayed register updates in real time. Values displayed in blue are writable and may be changed by clicking on them.

Tag(name)

Tag is a configurable name for each register. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is Nx where x is the register number.

Vis(ible)

Check the box for each register that you wish to have visible in configuration and display lists in other sections. By default, all N registers have their visibility check box unchecked (turned off).

Wr(itable)

Select this attribute to make a register writable through the configuration pages. This attribute has no effect on changes made via communications or any of the HMIs.

Rtn (retained)

Select this attribute to make a register retain its contents when the module is powered off or reset.

Format

The register format selection determines how the value of a register is interpreted and display in the configuration web pages. There are selections for 16-bit and 32-bit signed and unsigned formats, as well as floating point. Since the N registers are natively 16-bit, selecting a 32-bit integer or floating point format combines two registers.

Units

An optional text descriptor of up to 8 characters.

B Registers Config

The B registers Config tab facilitates configuration of "B" Boolean registers; setting tag names, attributes and associating individual B registers with up to eight alarm groups.

Value

Green "LED" indicators show the digital input Boolean states, updating in real time.

Tag(name)

Tag is a user settable name for each register. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is DIx where a is the input number.

Vis(ible)

Check the box for each register that you wish to have visible in configuration and display lists in other sections. By default, all B registers have their visibility check box unchecked (turned off).

Wr(itable)

Select this attribute to make a register writable through the configuration pages. This attribute has no effect on changes made via communications or any of the HMIs.

Rtn (retained)

Select this attribute to make a register retain its state when the module is powered off or reset.

Alarm Controls

B Boolean register can be set to initiate the annunciation of an alarm when they turn on. Alarms can be directed to one or more groups of contacts as selected by the eight alarm enable checkboxes. An Alarm Disable (AlmDis) checkbox is also provided for each Boolean point to easily disable an alarm momentarily; typically for maintenance purposes.

Import/Export

Modulus modules can import and export their register information to a .CSV type spreadsheet file using the Import and Export buttons on this page. The information is stored in a file called **reginit.csv**

The content of a typical reginit.csv file is depicted below:

```
:REG:,Value,TagName,Units,Format,Visible,Write En,Retain
N1,1111,Level_1,ft.,0,1,1,0
N2,0,Pump1_Temp,,0,1,1,0
N3,0,Pump2_Temp,,32,1,0,0
N5,0,Test_Register,,0,1,1,0
N6,0,Flow,,0,1,1,0
N11,0.0,I11,,114,0,0,0
B1,0,Pump1_Call,,,1,0,0
B2,0,Pump2_Call,,,1,0,0
B3,0,Pump1_Running,,,1,0,0
B4,0,Pump2_Running,,,1,0,0
```

Each line represents the information for a single register. The register information is delimited by commas. Values that should be left unaltered have no data between a pair of commas. The information fields are:

Register ID

Use Nxxx or Bxxx to identify the register associated with the data in the rest of the line.

Value

A value in this field will be forced into the register on power up or a reset.

Register Tag Name

All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character.

Units

An optional text descriptor of up to 8 characters. This is only used for N (numeric) registers

Format

A number (between 0 and 121) that describes the data format of numeric registers. The format numbers can be seen in the format selection list on the "N register Config" page. This field is only used for N (numeric) registers.

Visible

Set to one for registers that should be visible in configuration and display lists in various configuration and display sections in the module.

Write En

Set to one for registers that should be writable through the configuration pages. This attribute has no effect on changes made via communications or any of the HMIs.

Retained

Set to one for registers that should make a register retain its state when the module is powered off or reset.

Mappings

Mirrored Modbus N Register Mapping

If this value is set then the N registers can be read/written by Modbus at the value entered here. This value is the starting register for all of the N registers and will point to N1. The Modbus type is "Holding Register".

The N1 register is also located at the normal address of 101.

Mirrored Modbus B Register Mapping

If this value is set then the B registers can be read/written by Modbus at the value entered here. This value is the starting register for all of the B registers and will point to B1. The Modbus type is "Coil Register".

The B1 register is also located at the normal address of 101.

MESH I/O (mesh communications modules only)

Mesh I/O supports communications with low-power remote I/O modules as well as with other mesh I/O modules and controllers. Mesh I/O automatically creates a "self healing" wireless communications network where any module can automatically act as a repeater so even when low transmission power is used, a wide area can be covered.

Communications modules with a built-in meshing radio have setup and status information specific to mesh I/O operation displayed under this tab.

I/O Status

Under this tab, the status of each mesh I/O device (or mesh connected controller) is displayed.

Tag Name

This is a descriptive name for the mesh I/O device. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character.

Addr

This is the address of the mesh device.

Statistics

Xmits and Rcvs

A pair of statistical counters is maintained for each port counting the number of messages successfully received and responses transmitted. The counters are 16-bit and "roll over" when they exceed their maximum value of 65535.

Elap(S)

This is a display of the amount of time that has elapsed since a message was received from this mesh device.

RSSI

This is the last signal strength reading received from the mesh device, in -dB. The reading is the signal strength measured by the device itself and communicated back as part of the entire response message.

CF

This Comm Fail count indicates the number of times that a message was not received from a mesh device.

Clear

Click on the "C" button to clear the statistical counts for each mesh device.

Status

Stat

This is a three-state status indicator for each mesh device. It can be:

- green (OK) for good communications,

- yellow (DL) for downloading (auto firmware update)
- red (Fail) for a failed connection.

PF

This is a display of the mesh remote I/O module Power Fail status.

LB

This is a display of the mesh remote I/O module Low Battery status.

AlmDis (Alarm Disables)

There are three types of alarms that will automatically be generated for every mesh I/O device:

- **CF** - Communications Failure
- **PF** - Power Failure (for battery backed mesh I/O devices such as the LPR I/O module)
- **LB** - Low Battery (for battery backed mesh I/O devices such as the LPR I/O module)

By checking the appropriate boxes, these alarms can be individually disabled. Disables are retained through a power cycle or reset of the unit.

View

Click on the button to see the last received data from a mesh device; the data will display on the right hand side. Data to be written to the mesh device is also shown but it is the current values and states in the Master. These may not reflect what was written to the device when the last data exchange took place.

Setup

Under this tab, the fundamental operation of the entire mesh I/O system common to all remote sites is configured.

Sleep Mode

Sleep Mode is used for extremely low-power consumption operation. It is especially important for use with the LPR (Low-Power Remote) I/O modules when running on the power from a single "D" cell lithium battery for several years at a time. All remote nodes that operate in this mode spend mode of their time in deep sleep consuming just a uA or so of current; just enough to run a timer that will wake them up when it is time to momentarily turn on power to any sensors, take measurements, and report back to the "Master". The Master responds with any output data that needs to be written as well as the latest configuration data for the node. When the data transaction is complete and verified, the master tells the remote to go back to sleep until it will be time to report in again.

Master Sleep Time (S)

This is the amount of time that the receiving remote nodes will go to sleep until it's time to take another set of samples and send them to the Master. The longer the sleep time the less current consumption is used from battery power.

Wake Window Percentage

The wake window percentage is the amount time before and after the scheduled wake-up time that the Master might expect messages from waking remotes. To minimize current consumption, the timer in the Low Power Remotes can have a couple of percent of tolerance over their operating temperature. In addition, any remotes that must be awake in order to serve as repeaters in the system need to wake up a little earlier than the rest to make sure that they are ready to repeat any messages as required.

Sleep Block Starting Address and Size

The entire mesh network can have up to 64 remote nodes and multiple Masters. These parameters define the range of addresses handled by the module (Master). In other words, this configuration is the starting address and number of remotes that the master will service.

Comm Fail Threshold

This sets the number of sequential cycles in which the Master will expect a message from a remote unit before declaring a communications failure with that unit.

Polling Mode

Mesh devices that are not low-power critical can use polling instead of the sleep operation described above.

Power Fail Polling Cycle Skip

The LPR I/O module supports both battery and external DC power operation. If the external DC power fails, the internal battery can automatically take over powering the unit. With external DC power, the power draw is not that critical so the frequent radio transmissions and their power consumption are not a problem. When the module must switch over to battery operation, it may be desirable to reduce the polling rate to conserve battery power. By setting this parameter to a non-zero value, the Master will skip the specified number of polling cycles effectively reducing the polling rate to this particular unit.

Polling Time (S)

Sets the time interval (in seconds) used to poll non sleep-mode mesh devices.

Comm Fail Probe Time (S)

When a polled device stops answering polls, the performance and throughput of the network is degraded. Each time the Master attempts to poll the device, it must wait for a timeout period before giving up and moving on. The mesh system supports probing. Instead of polling a failed device at the "normal" polling rate, the Master using a slower "Probe Time" to periodically but less frequently check to see if the device is back up. This parameter, if non zero, set that probe time.

Response Timeout (S)

Sets the maximum time interval (in seconds) that the Master will wait for a response after polling a mesh device.

Comm Fail Threshold

Sets the number of sequential failed responses required to declare that a mesh device communications link has failed.

Slave Setup

In addition to operating as masters, Modulus Mesh Communications modules can act as slaves on a mesh network. The parameters associated with slave operation are set in this section.

Slave Address

A selection list ranging from 0 to 255 (FF).

Slave Comm Fail Watchdog (S)

The Mesh Communications module when operating as a slave can determine if communications to it has failed if a message is not received at least as frequently as the Slave Watchdog time setting. When a communications failure is detected, a status bit is set that can be used to initiate an alarm or a control action in the programming section. A value of 0 disables this functionality.

Mesh Slave Comm Fail

Alarm Group En (1-8)

If there is a mesh slave communications failure, the module can announce the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for a mesh slave communications failure can be disabled by checking this box.

Remote Alarm Group Enables

The mesh communications system detects the following error conditions and can generate alarms when they are detected while communicating with a remote mesh slave device:

- Communications Failure (CF)
- External DC Power Failure (PF)
- A Low Battery condition (LB)

I/O Mapping

Under this tab, the configuration of communications to individual mesh devices is set including the "mapping" of data registers in the Master to and from mesh device I/O and registers.

Tag(name)

Tag is a user settable name for each remote mesh device. All tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is Remote_x where x is the a number between 1 and 64.

Model

The Model selection provides a drop down selection list of the types of mesh devices. These can be any one of the following:

- LPR (Scadaflex Low Power Remote I/O module)
- SCx (Scadaflex II model SC1, SC2 or SC3 controller)
- RIO (Scadaflex Remote I/O module)
- Modulus (Mesh Communications module)

Select the device associated with this address.

Mode

A selection list of the types of communications modes supported by each model.

For LPR (Scadaflex Low Power Remote I/O module), these are

- Timed Sleep - Lowest power consumption mode where the module stays asleep for the longest amount of time.
- Timed Sleep Repeater - A slightly higher power consumption mode where the module wakes up early at the beginning of the wakeup time window and stays awake late until the end of the wakeup time window to be available as a repeater node.
- Timed Always Awake Repeater- A higher power consumption mode where the module is always awake and acts as a repeater for all of the timed sleep nodes. Typically this mode is used when external DC power (such as solar power) is available.
- Polled- The module is always awake and uses polled communications instead of sleep mode.

For the RIO (Scadaflex Remote I/O module), Scadaflex (SC1, SC2 and SC3) controllers, and Modulus Mesh Communications modules, the following communications modes are supported:

- Polled - The module is communicated with at the polling rate.
- Sleep Sync Polled - The module is communicated with at the sleep cycle rate (usually much slower than the polled rate). This mode can conserve power consumption for mesh devices that are externally powered but must still conserve power such as small solar powered sites.

Address

This is a selection list ranging from 0 to 255 (FF) to set the address of the mesh device.

Mesh Cal

The “Mesh Cal” calibration mode is for advanced users only! The checkbox turns on the calibration mode for all Remotes that support it (LPR and RIO). All Inputs for each unit must be mapped for calibration values to show under the Remote’s View mode. This action should be done in “Polled” mode and not one of the Sleep modes. In the case of the RIO, a calibration Mode will need to be selected before sending the calibration value. Apply the correct input to the remote unit then specify the “Cal Val” and when ready, click the “Send” button. The calibration will be sent to the remote unit.

Cfg

Click on this button to "map" the data in the remote device to and from registers in the Master. Data is transferred in blocks, so the mapping uses starting registers and/or I/O points in both the Master and the remote device and a count (block size). The available selections "morph" based on the type of mesh devices selected.

View

Click on this button to view the Master’s local data in the mapped registers.

Communications

The Communications tab provides a means to configure all module communications via Ethernet, serial port(s) and optionally, internal radio or modem. Both slave and mastering operation is supported on any port. In some cases, as with Ethernet, or when running a peer-to-peer protocol on a serial port or internal radio, a port can operate both as a master and a slave at the same time.

Slave Status

Any communications port (Ethernet, serial or internal radio) can be used for slave communications where an external device initiates messages that the module responds to. Under this tab, the status of each port, as related to slave communications operation, is displayed.

*Xmits and Rcv*s

A pair of statistical counters is maintained for each port, counting the number of messages successfully received and responses transmitted. The counters are 16-bit and "roll over" when they exceed their maximum value of 65535.

Status and Fails

Each port has a Slave Watchdog Timer. When set, the module can determine if a slave communications failure has occurred if a message is not received at least as frequently as the Slave Watchdog time setting. The current state of slave communications is displayed for each port in the Status column while a count of the number of times that slave communications has failed is displayed in the Fail column.

Max(S) and Last(S) Latency

The module maintains statistical counts on the time between messages received from a master on each port. There are counts displayed for both the maximum and last time values.

Source and Dest(ination)

These values show the address of the last device from which a message was received (Source), and if applicable, retransmitted or repeated (Dest)

Clear

Click on the "C" button to clear the counts for each communications port.

Master Status

Any communications port (Ethernet, serial or internal radio) can be used to master (initiate) communications with one or more external devices. The module can master messages to multiple devices (destinations). The configuration of destinations (tag names, ports, protocols, addresses, etc.) is done under the Master Destinations tab of this section. Under this tab, the status of each destination as related to master communications operation is displayed.

Destinations

The module can be a master to up to total of 32 destination devices across all of its communications ports. Statistics and status are maintained for each destination.

Disable

For maintenance and diagnostic purposes, communications mastering to any destination can be disabled by clicking on the appropriate button in this column. This disable is retained through a unit reset or power cycle.

Xmits and Rcvs

A pair of statistical counters is maintained for each destination counting the number of messages transmitted and responses received successfully. The counters are 16-bit and "roll over" when they exceed their maximum value of 65535.

Fails and Status

Each port has a Response Timer. When set, the module can determine if a communications failure has occurred when response message is not received within the Response Timeout setting. The current state of master communications is displayed for each port in the Status column while a count of the number of times that master communications has failed is displayed in the Fail column.

Max(S) and Last(S) Latency

The module maintains statistical counts on the time from when a message is sent out to a destination to the time that a response is received. There are counts displayed for both the maximum and last time values.

Clear

Click on the button to clear the statistical counts for each individual destination.

Ethernet

The module's Ethernet port is used for module configuration, register data communications, Internet protocol communications, and file data transmission. This section configures all aspects of communications via the module's Ethernet port. Protocols include:

Data Exchange:

- Modbus TCP/UDP
- SDX (Secure Data Exchange)
- Ethernet IP

Internet Protocols:

- NTP - Network Time Protocol (client only)
- HTTP - (for configuration and display)
- DNS - Domain Name Server (client only)
- DHCP - Domain Host Control Protocol (server and client)
- SMTP - Simple Mail Transfer Protocol (client only)
- POP3 - Post Office Protocol (client only)
- FTP - File Transfer Protocol (server and client)

Local IP, Subnet Mask and Gateway

The IP address, subnet mask and gateway address are set under this tab. Changes to these values do not take effect until the module is reset. Clicking on the "Set Local IP now" button resets the module.

DNS Server IP and Lookup Holdoff

For some Ethernet transactions, the destination IP is actually a name that must be translated to a "real" IP address. The module communicates with a DNS server to accomplish this translation. The address of a DNS server must be entered as the DNS Server IP. If the module is unable to reach the DNS server, it will hold off trying again for the "DNS Lookup Holdoff Time" period.

Enable Web Accelerator

ICL maintains a web server on the Internet with a copy of the major/largest files used in the Modulus modules. When your browser requires these files, it can retrieve them either from the module itself, or from the web server "in the cloud". Depending on the speed of the Internet connection to the module, retrieving the files from the Internet web server can be faster and in the case of a cellular connection, at reduced cost. When this box is checked, your browser will be instructed to try to retrieve the files from the Internet web server first instead on the I/O module. Should that operation fail and the ICL web server cannot be reached, the browser will get the files locally anyway.

DHCP Mode

- DHCP OFF—means that no DHCP configuration is used.
- Get IP By DHCP—on some networks, a fixed address is not available or cannot be used. In these cases, a DHCP server can provide an address to the module. This mode causes the module to get its settings from a DHCP server instead of using the fixed values above.
- DHCP Server Enable—the module can serve addresses on a network that are compatible with its own IP settings if this mode is set. This can eliminate the need to constantly set one's own laptop or computer to a static IP to access the module. **Be careful to not enable this feature if there is another DHCP server on your network (such as with a corporate network). This will conflict with the module and your server and could cause your network to crash!**

HTTP Port

The standard port address for HTTP (web page) access is port 80 but in some cases this will need to be changed. For example, if multiple web devices are located "behind" a shared router, the HTTP port address can be set to a different value here. If it is changed, the web pages in the module may be accessed by entering a colon and the port number after the IP address:

<module IP address>: <port#>

PrePing (S)

If the Ethernet port is connected to an external cellular router or modem, you may need to enter a PrePing time that will cause the module to send out a very short message before the main message in order to "wake up" the tower connection. Some networks (such as Verizon) will frequently drop the first message after an idle period of time forcing wasteful retries because of the initially dropped messages.

A time period of 4 to 5 seconds is typical, but may vary by carrier and region. A value of 0 disables this feature.

Protocol Configuration

Protocols used for passing register data are configured in this section for network communications compatibility with other devices and to secure access to the module by allowing unused protocols to be disabled.

SDX Slave Enable, Address, and Port

Set these parameters for SDX (Secure Data Exchange) protocol communications. Note that the AES encryption key used by the SDX protocol is set under the System|Security tab.

Modbus TCP/UDP Slave Enable, Address, and Port

Set these parameters for Modbus TCP/UDP Slave protocol communications.

Ethernet IP Address

Check this box to enable slave communications over Ethernet with Allen Bradley. There is no (sub) address setting and the port number cannot be changed.

Ethernet Slave Comm Fail

Alarm Group En (1-8)

If there is a failure of slave communications to the module over Ethernet, the module can annunciate the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for Ethernet Slave communications failures can be disabled by checking this box. This disable is retained through a unit reset or power cycle.

Slave Comm Fail Watchdog

Slave communications failures on the Ethernet port are detected by sensing that a message has not been received from a master for a settable time period. To detect Ethernet slave communications failures, enter a watchdog time period here (in seconds). 0 disables this feature.

Slave Status

The status of slave communications from any masters over Ethernet is displayed in this section.

Xmits and Rcvs

A pair of statistical counters is maintained for Ethernet port slave communications, counting the number of messages successfully received and responses transmitted. The counters are 16-bit and "roll over" when they exceed their maximum value of 65535.

Status and Fails

The Ethernet port has a Slave Watchdog Timer (described above). When set, the module can determine if an Ethernet slave communications failure has occurred when message is not received at least a frequently as the Slave Watchdog time setting. The current state of Ethernet slave communications is

displayed as the "Status" while a count of the number of times that slave communications has failed is displayed just below it.

Max(S) and Last(S) Latency

The module maintains statistical counts on the time between messages received from any masters on the Ethernet port. There are counts displayed for both the maximum and last time values.

Source and Dest(ination)

These values show the address of the last device from which a message was received (Source), and if applicable, retransmitted or repeated (Dest). These values only apply to the SDX protocol.

Clear

Click on the button to clear the statistical counts for the Ethernet port.

Mastering

If the module is used to initiate register communications to other slave devices, the following parameters should be set.

Polling Time

This parameter determines how frequently the module attempts to initiate polled message transactions with slave devices.

Response Timeout

This parameter set the maximum amount of time that the module will wait for a response from a slave device before giving up and moving on to the next device. Setting this time period too long will slow network operation when one or more slave devices fail. Setting the time to short may cause responses to be missed due to network latency.

Retry Count

This parameter sets the number of times that the module will attempt to resend a message before declaring a communications failure to the destination device.

Comm Fail Probe Time

When communications fails to a destination, the module will attempt to "probe" the device, typically at a reduced rate, to see when it comes back on-line. This reduces the impact on network performance from failed devices on the network. Set this value to 0 to disable probing.

Use Retries on Probing

If communications is especially bad to a destination, retries on probing may be needed to get at least some communications to a device. Check this box to enable retries on probing. The number of retries used is the same as the value set for polling above.

Any master Comm Fail

Alarm Group En (1-8)

If there is a failure of master communications to any destination, the module can annunciate the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for any master communications failures can be disabled by checking this box. This disable is maintained through a reset or power cycle of the unit.

NTP Server Address and NTP Test button

If the module has access to the Internet, it can get a time update from a Network Time Server using the standard NTP protocol. The IP address of the NTP Server should be entered here. The access to the NTP server can be tested by clicking on the Test NTP button.

Bus

The Bus port on Modulus modules may be used as a high-speed interconnection port with other modules, or as a standard RS-485 communications port when in a single module system. The operation is selected as the "Bus Mode".

Mode

Bus Mode

This is a selector list that selects whether the port is configured as a high-speed communications link with other Modulus modules, or used as a conventional RS-485 serial communications port when the module is used as a stand-alone device. The speed of the inter-module communications mode can be selected as high (1mb/s), medium (500kb/s) or slow (100kb/s) to accommodate differing bus lengths up to 1000 feet or more (see Modulus Installation manual).

Inter-module Bus Mode (IOX) Operation

If the Bus Mode is set to Fast Bus, Medium Bus or Slow Bus, parameters specific to the IOX backplane operations show in the page.

General

Bus Address

This value is a unique address for this module on a bus with other Modulus modules. For most systems, it is typically a value between 1 and 32 as a primary module and between 33 and 64 for a redundant backup module. The maximum slot address is 254.

Bus Slave Comm Fail

Alarm Group En (1-8)

If there is a failure of communications to the module over the bus, the module can annunciate the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for Bus Slave communications failures can be disabled by checking this box. This disable is retained through a unit reset or power cycle.

Slave Comm Fail Watchdog

Slave communications failures on the Bus are detected by sensing that a message has not been received from a master for a settable time period. To detect Bus slave communications failures, enter a watchdog time period here (in seconds).

Module I/O Mastering

When the module operates as a "master" gathering data from other "slave" modules, the following parameters take effect:

Time Sync Master

Checking this box enables this module to operate as a time server to the rest of the modules on the bus. This is most appropriate if the module has an Internet connection to get its own time updates, or if it is a communications module with a battery backed clock and calendar. Note that there can be multiple Time Sync Masters on the bus.

Digital I/O, Analog I/O and Register Polling Times

This parameter determines how frequently the module gathers various types of data over the bus. For example, since analog conversions typically happen at a slower rate than digital I/O changes, the polling rate for analog data normally runs slower to reduce the impact on the total bus throughput.

Max Discovery Slot

This parameter should be set to no less than the maximum module (slot) address on the bus.

IOX Slot Comm Fail

Alarm Group En (1-8)

I/O exchange (IOX) is the peer-to-peer protocol used between Modulus I/O modules. If there is a failure of IOX communications over the bus, the module can annunciate the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for IOX Slot communications failures can be disabled by checking this box. This disable is retained through a unit reset or power cycle.

IOX Disables

Web, SDX and Modbus Redirects

I/O exchange (IOX) supports the passing of web pages as well as SDX and Modbus messages redirected from a receiving module, over the bus, and out another module. In some cases, this may open up a security risk. These check boxes allow some or all IOX redirecting to be disabled.

Slave Status

The status of slave communications from other masters on the bus is displayed in this section.

Xmits and Rcvs

A pair of statistical counters is maintained for IOX packet slave communications, counting the number of messages successfully received and responses transmitted. The counters are 16-bit and "roll over" when they exceed their maximum value of 65535.

Status and Fails

The Bus port has a non user settable Watchdog Timer. The module can determine if bus a communications failure has occurred if a message is not received at least a frequently as the Watchdog time. The current state of bus communications is displayed as the "Status" while a count of the number of times that bus communications has failed is displayed just below it.

Max(S) and Last(S) Latency

The module maintains statistical counts on the time between messages received from any masters on the bus. There are counts displayed for both the maximum and last time values.

Source and Dest(ination)

These values show the address of the module from which a message was received (Source), and if applicable, retransmitted or repeated (Dest).

Clear

Click on the button to clear the counts for each communications port.

IOX Stats

IOX Health

Since the Modulus bus can be distributed over hundreds of feet, there is a potential of data errors in extremely noisy environments--especially if proper cabling precautions are not taken. The IOX health counter can assist in detecting and troubleshooting bus error conditions. The value of the IOX Health counter is initially set to 60000. If a CRC data error occurs in a received packet, the counter is set to 0. Each successive good packet increments the count to a maximum of 60000, so the health value represents that number of good packets received since the last data failure.

IOX Checksum Errors

This is a 16-bit counter that is incremented each time a corrupted IOX packet is received. The value can be changed (cleared) by clicking on it.

RS-485 Bus Mode (non IOX) Operation

If the Bus Mode is set to RS-485 mode, the port becomes a normal two wire RS-485 interface and operates as a standard serial communications port. The Communications|Bus page will then show the appropriate configurations for this style of port.

General

Modbus/DF1

This value is a unique address for this port for slave protocols. For Modbus communications, the maximum address is 254. For SDX communications, the maximum address is 65535.

Baud Rate

This is a selection list that determines the serial communications rate from 1200 to 115,200 baud.

Databits-Parity-Stopbits

This is a selection list that determines the serial communications format.

TxEn Delay (mS)

The Transmit Enable Delay is the minimum time from when the RS-485 driver is turned on to when the module begins to transmit a message. 3mS is the default value and appropriate for most applications.

Receive Character Gap

Some protocols such as Modbus use the gap between characters to frame their messages. 1 is the default value and appropriate for most applications.

Bus Slave Comm Fail

Alarm Group En (1-8)

If there is a failure of communications to the module over the bus, the module can annunciate the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for Bus Slave communications failures can be disabled by checking this box. This disable is retained through a unit reset or power cycle.

Slave Comm Fail Watchdog

Slave communications failures are detected by sensing that a message has not been received from a master for a settable time period. To detect slave communications failures, enter a watchdog time period here (in seconds). A value of 0 disables this feature.

Protocol (Disables)

Unused slave protocols can be a security "hole". If this is a concern, disable them here.

Modbus Store & Forward

Although there is no defined standard in the Modbus protocol for message repeating, the module can serve as a Modbus repeater. A range of incoming addresses are rebroadcast as a shifted range addresses of outgoing repeated messages, and vice versa.

In Address

First address of a block of addresses to be repeated.

Out Address

First address of a block of addresses to which the incoming messages will be repeated.

Block Size

Block size is the number of addresses to repeat.

Mastering

If the module is used to initiate register communications to other slave devices, the following parameters should be set.

Polling Time

This parameter determines how frequently the module attempts to initiate a message transaction with slave devices.

Quiet Time (mS)

In peer to peer environments, the module will "listen" for message traffic for the specified amount of time before attempting to transmit a message.

Response Timeout

This parameter sets the maximum amount of time that the module will wait for a response from a slave device before giving up and moving on to the next device. Setting this time period too long will slow network operation when one or more slave devices fail. Setting the time too short may cause responses to be missed due to network latency.

Retry Count

This parameter sets the number of times that the module will attempt to resend a message before declaring a communications failure to the destination device.

Comm Fail Probe Time

When communications fails to a destination the module will attempt to "probe" the device. This is typically at a reduced rate, to see when the device comes back on-line. This reduces the impact on network performance from failed devices on the network. Set this value to 0 to disable probing.

Use Retries on Probing

If communications is especially bad to a destination, even retries on probing may be needed to get at least some communications to a device. Check this box to enable retries on probing. The number of retries used is the same as the value set for polling above.

Any Master Comm Fail

Alarm Group En (1-8)

If there is a failure of master communications to any destination, the module can announce the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for any master communications failures can be disabled by checking this box. This disable is retained through a unit reset or power cycle.

Slave Status

The status of slave communications from any masters is displayed in this section.

Xmits and Rcvs

A pair of statistical counters is maintained for slave communications, counting the number of messages successfully received and responses transmitted. The counters are 16-bit and "roll over" when they exceed their maximum value of 65535.

Status and Fails

The serial port has a Slave Watchdog Timer. When set, the module can determine if a slave communications failure has occurred if a message is not received at least as frequently as the Slave Watchdog time setting. The current state of slave communications is displayed as the "Status" while a count of the number of times that slave communications has failed is displayed just below it.

Max(S) and Last(S) Latency

The module maintains statistical counts on the time between messages received from any masters. There are counts displayed for both the maximum and last time values.

Source and Dest(ination)

These values show the address of the last device from which a message was received (Source), and if applicable, retransmitted or repeated (Dest).

Clear

Click on the button to clear the counts for each communications port.

Ethernet Bridging

Ethernet Bridging allows protocol messages to pass between the Ethernet port of the Modulus module to serial devices connected to a serial port of any module on the bus. This can apply specifically to Modbus (Modbus TCP/IP <--> Modbus RTU) or any other packet based protocol. For example, there are several free or low-cost virtual serial port programs that run under Windows that work with Modulus modules to make a program that expects to talk to a serial device connected to a local serial port on a PC and instead connect to the same device on a serial port on a Modulus module.

Bridging Mode

Select either Modbus, or Passthru for any other protocol

Pass-through Bridge Port

Enter the Ethernet port number here to be used if you are using Passthru bridging. Modbus bridging uses the port designated under the COMMUNICATIONS|Ethernet tab, which is typically port 502.

Bridge Address

If a message initiates on a serial port to IP address or name (using DNS lookup) it is entered here to define the destination address for the message.

Etherlogic Mode

Check this box if you are using the Eterlogic (eterlogic.com) serial port emulation software.

Modbus Start Address and Range

Enter the starting address and number of addresses that are to be forwarded out through the serial port when using Modbus bridging.

Com(x)

Modulus I/O modules can have one or more serial ports in addition to the bus port. These ports are software configurable for RS-232, RS-485, RS-422 Satellite (Com1 only if available), SDI-12 (Com1 only if available) or Ultrasonic (Com1 only if available). Each serial port has its own tab under communications for configuration as follows:

Port Mode

A selection list to select the hardware interface of the serial port: RS-232, RS-485, RS-422 Satellite (Com1 only if available), SDI-12 (Com1 only if available) or Ultrasonic (Com1 only if available).

General

This section is the port configuration and may be disabled under some Port Mode configurations.

Baud Rate

This is a selection list that determines the serial communications rate from 1200 to 115,200 baud.

Databits-Parity-Stopbits

This is a selection list that determines the serial communications format.

TxEn Delay (mS)

The minimum time from when the RS-485 driver or Request-to-Send (RTS) signal is turned on to when the module begins to transmit a message. 3mS is the default value and appropriate for most RS-485 applications. For older radios and modems that use RTS to "key the transmitter" or turn on a carrier, longer times of 500mS or more may be required.

Receive Character Gap

Some protocols such as Modbus use the gap between characters to frame their messages. 1 is the default value and appropriate for most applications.

Protocol (Enables)

This section may be disabled under some Port Mode configurations.

Unused slave protocols can be a security "hole". If this is a concern, disable (uncheck) them here.

SDX Address (Global)

This is the SDX protocol address which also applies IP interfaces as well and is individual per unit.

Modbus/DF1 Address

This value is a unique address for this port for slave protocols. For Modbus communications, the maximum address is 254.

Comx Slave Comm Fail

Alarm Group En (1-8)

If there is a failure of master communications to any destination, the module can announce the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for any master communications failures can be disabled by checking this box. This disable is retained through a reset or power cycle of the unit.

Slave Comm Fail Watchdog (S)

Slave communications failures are detected by sensing that a message has not been received from a master for a settable time period. To detect slave communications failures, enter a watchdog time period here (in seconds). A value of 0 disables this feature.

Slave Status

The status of slave communications from any masters is displayed in this section. This section may be disabled under some Port Mode configurations.

Xmits and Rcvs

A pair of statistical counters is maintained for slave communications, counting the number of messages successfully received and responses transmitted. The counters are 16-bit and "roll over" when they exceed their maximum value of 65535.

Status and Fails

The serial port has a Slave Watchdog Timer. When set, the module can determine if a slave communications failure has occurred if a message is not received at least as frequently as the Slave Watchdog time setting. The current state of slave communications is displayed as the "Status" while a count of the number of times that slave communications has failed is displayed just below it.

Max(S) and Last(S) Latency

The module maintains statistical counts on the time between messages received from any masters. There are counts displayed for both the maximum and last time values.

Source and Dest(ination)

These values show the address of the last device from which a message was received (Source) and if applicable, the retransmitted or repeated destination (Dest).

Clear

Click on the button to clear the counts for each communications port.

Modbus Store & Forward

Although there is no defined standard in the Modbus protocol for message repeating, the module can serve as a Modbus repeater. A range of incoming addresses are rebroadcast as a shifted range addresses of outgoing repeated messages, and vice versa. This section may be disabled under some Port Mode configurations.

In Address

First address of a block of addresses to be repeated.

Out Address

First address of a block of addresses to which the incoming messages will be repeated.

Block Size

The number of addresses being repeated.

Mastering

If the module is used to initiate register communications to other slave devices, the following parameters should be set. This section may be disabled under some Port Mode configurations.

Polling Time (S)

This parameter determines how frequently the module attempts to initiate a message transaction with slave devices.

Quiet Time (mS)

This is used for peer-to-peer environments. The module will "listen" for message traffic for the specified amount of time before attempting to transmit a message.

Response Timeout (S)

This parameter sets the maximum amount of time that the module will wait for a response from a slave device before giving up and moving on to the next device. Setting this time period too long will slow network operation when one or more slave devices fail. Setting the time too short may cause responses to be missed due to network latency.

Retry Count

This parameter sets the number of times that the module will attempt to resend a message before declaring a communications failure to the destination device.

Comm Fail Probe Time (S)

When communications fails to a destination, the module will attempt to "probe" the device typically at a reduced rate to see when it comes back on-line. This reduces the impact on network performance from failed devices on the network. Set this value to 0 to disable probing.

Use Retries on Probing

If communications is especially bad to a destination, retries on probing may be needed to get at least some communications to a device. Check this box to enable retries on probing. The number of retries used is the same as the value set for polling above.

Any Master Comm Fail

Alarm Group En (1-8)

If there is a failure of master communications to any destination, the module can announce the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for any master communications failures can be disabled by checking this box. This disable is retained through a unit reset or power cycle.

Ethernet Bridging

Ethernet Bridging allows protocol messages to pass between the Ethernet port of a Modules module to serial devices connected to a serial port of any module on the bus. This can apply specifically to Modbus (Modbus TCP/IP <--> Modbus RTU) or any other packet based protocol. For example, there are several free or low-cost virtual serial port programs that run under Windows that work with Modulus modules to make a program that expects to talk to a serial device connected to a local serial port on a PC instead connect to the same device on a serial port on a Modulus module. This section may be disabled under some Port Mode configurations.

Bridging Mode

Select either Modbus, or Passthru for any other protocol

Pass-through Bridge Port

Enter the Ethernet port number here if you are using Passthru bridging. Modbus bridging uses the port designated under the COMMUNICATIONS|Ethernet tab, which is typically port 502.

Bridge Address

If a message initiates on a serial port, the IP address or name (using DNS lookup) entered here defines the destination address for the message.

Eterlogic Mode

Check this box if you are using the Eterlogic (eterlogic.com) serial port emulation software.

Modbus Start Address and Range

Enter the starting address and number of addresses that are to be forwarded out through the serial port when using Modbus bridging. This section may be disabled under some Port Mode configurations.

Cellular (cellular communications modules only)

Communications modules with a built-in cellular modem have setup and status information specific to cellular operation displayed under this tab.

Cellular

Cell Tower Comm Fail

This is a basic OK/Fail status of the basic link to a local cellular tower.

Cell Tower RSSI

The strength of the receive signal is displayed here in -dB. Typically, this will range from about -40dB for an extremely strong signal, to about -100 dB for a weak signal. Signal strengths of less than -100dB can sometimes provide some communications, but should be corrected for reliable operation.

Cellular Number

This is the telephone number assigned by the cellular carrier. This number is used to identify the account as well as the number for text message communications. The cellular number is stored in the SIM card, so the existence of the number does NOT confirm that a link has been successfully established to a cell tower.

Last Cell Number

This is the telephone number from which a text message was last received.

Cellular IP

This is the IP address assigned by the carrier for data communications over the Internet. Whether the account is assigned a static or dynamic IP address, it is passed down from the cell tower and not stored in the SIM card.

Cell SMS Delivery Latency (S)

This is the difference between the time stamp in the last received text message compared with the time when the message was received. Because of potential delays in delivery of text messages in cellular networks, "old" messages can be set to be rejected if they exceed a certain amount of time. For example, if text messaging is used to send control information and that information is received late, it may be stale and not usable for safe control operation. The latency measurement can be used to help set that limit.

IMEI Number

This is the electronic serial number of the cellular modem hardware. Note that it will only be displayed if a SIM card is installed and there is a useful signal strength reading. It is not dependent on an account being properly set up.

Billing Day of the Month and Data/SMS Rx/Tx Statistics

The communications module keeps track of the current and last month's data bytes, text messages sent and text messages received to know when plan specific billing thresholds are about to be reached. This is to facilitate comparison with the billing information from the carrier. The billing day of the month should be set to make the module aware of when it should save off the current month's information and start the next month's counts.

General

Use Accelerator over Cellular

Many of the system files that are loaded by the browser when the module is accessed are also kept on a “cloud” server available on the Internet. By checking this box, the module will cause your browser to attempt to load these files from that cloud server first before serving them over the cellular link from the module. This can potentially enhance the speed of the file loading time as well as reduce cellular data charges. When enabled, there is a small extra delay caused by the browser having to check for access to the server. When disabled, the files will always be downloaded over the cellular link.

Cellular Ping/Pre-ping IP

This IP address is for the operation of the cellular link watchdog and pre-pinging for cellular messages. The module needs a reliable IP address on the Internet that is always available. Enter that IP address here. By default, the IP address is set to 8.8.8.8 which is the Google DNS server.

Cell Wakeup Ping Delay

On some cellular networks (such as Verizon), the first message of a data transmission may be lost or dropped if the module has not communicated over the cellular network for a period of time (typically greater than about 6 seconds). This causes delays and retries to re-establish reliable communications. To avoid these delays, the module can be set to send out a very short "pre-ping" message ahead of the "real" message in order to "wake up" the tower and stimulate the IP network connection. Typically 5 seconds is a good starting point for this setting.

Wakeup Ping Holdoff

If the module has used the cellular link recently, then sending a pre-ping message ahead of a data packet is not required. Set this time to hold off sending pre-ping messages if data has been sent within the specified time period.

Use Ethernet DNS for the Cell Modem

Check this box to use the same Dynamic Name Server (DNS) settings setup by the Ethernet port.

Force APN

The APN (Access Point Name) for the cellular account is normally set when the account is established and the cellular module is first installed. It is required for data communications (not text messaging). It is possible for the APN to be altered by the tower which can effectively disable data communications with the module over the cellular link. By setting the APN in this parameter, the cellular module will re-establish the APN setting each time the module is reset. Used in combination with the cellular ping watchdog, the module can autonomously re-establish the APN if the cellular link to the Internet fails.

Cellular Watchdog Ping Interval (H)

This sets how often the module tests the cellular connection to the Internet.

Cell Tower link Fail Delay (S)

A failure of the link to the cell tower sets can set a status bit readable in a logic program and generate an alarm. In some locations, momentary dropouts can occur but the link is quickly re-established. Set this

delay time to a value that will avoid false alarms for short-term dropouts of the cell tower link. Typical values will range from 10 to 60 seconds.

Cell ComFail Delay (M)

This value sets a delay for generating a status bit readable in a logic program and an alarm when a data communications failure occurs over the cellular link. Typical value will be 5 to 10 minutes.

Old Message Timeout (M)

When a text message is received, its internal timestamp is compared to the time in the module. This value sets a limit on the how late (or early) the message can be and still be accepted. This is especially important if text messages using the STM protocol are being used to initiate control actions.

Cell Receive Time Zone Offset

Some cellular networks such as Verizon use the local time as the timestamp in text messages while others use GMT time. For Verizon and similar systems, enter a time zone offset to correct for this difference.

Disable Cellular Data

Check this box to disable data communications over cellular. This effectively disconnects the module from the Internet (via cellular). Even if this box is checked, if the module is configured to initiate (master) data messages via cellular, the module will momentarily turn on and establish a data connection to the tower to get that message and its response through. The data link is then automatically turned back off. This can be used to help secure the module on the Internet while still using the Internet for occasional data exchanges for "report on exception" events.

Cellular Stealth Mode

If checked, the cellular modem and TCP/IP stack will not act as a server but may be used for outgoing communications (communicating with an MQTT Broker for example). All responses to incoming connections are disabled to save data charges and decrease the chances of Denial of Service attacks.

Data Enable Key

This is a string when configured, can turn on the enable or disable Cellular data via a text message to temporarily allow ip data access over the cellular for configuration and other ip network access.

Cell Slave Comm Fail

Alarm Group En (1-8)

If there is a failure of slave communications to the module over Ethernet, the module can announce the problem to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for Ethernet Slave communications failures can be disabled by checking this box. This disable is retained through a unit reset or power cycle.

Slave Comm Fail Watchdog

Slave communications failures over cellular are detected by sensing that a message has not been received from a master for a settable time period. To detect cellular slave communications failures, enter a watchdog time period here (in seconds). Entering a 0 disables this feature.

Protocol

Slave protocols used for responding to register requests are configured in this section for network communications compatibility with other devices and to secure access to the module by allowing unused protocols to be disabled.

SDX Slave Enable, Address, and Port

Set these parameters for SDX (Secure Data Exchange) protocol communications. Note that the AES encryption key used by the SDX protocol is set under the System|Security tab.

Modbus TCP/UDP Slave Enable, Address, and Port

Set these parameters for Modbus TCP/UDP Slave protocol communications.

HTTP Port

If needed, enter an alternative port number for the HTTP (web server) port here. Port 80 is the default setting.

STM Slave Enable

Check this box to enable responding to STM encrypted register communications requests.

Text Command Enable

Check this box to enable responding to (unencrypted) text message commands. Be aware that this can be a significant security risk if abused.

Accept Only Known Contacts

Check this box to enable accepting text messages only from telephone numbers in the Contact List (see Alarming and Reports).

Mastering

If the module is used to initiate register communications to other slave devices via cellular, the following parameters should be set.

Polling Time

This parameter determines how frequently the module attempts to initiate a message transaction with slave devices.

Response Timeout

This parameter set the maximum amount of time that the module will wait for a response from a slave device before giving up and moving on to the next device. Setting this time period too long will slow network operation when one or more slave devices fail. Setting the time too short may cause responses to be missed due to network latency.

Retry Count

This parameter sets the number of times that the module will attempt to resend a message before declaring a communications failure to the destination device.

Comm Fail Probe Time

When communications fails to a destination, the module will attempt to "probe" the device typically at a reduced rate to see when it comes back on-line. This reduces the impact on network performance from failed devices on the network. Set this value to 0 to disable probing.

Use Retries on Probing

If communications is especially bad to a destination, even retries on probing may be needed to get at least some communications to a device. Check this box to enable retries on probing. The number of retries used is the same as the value set for polling above.

Any master Comm Fail

Alarm Group En (1-8)

If there is a failure of master communications to any destination, the module can announce the error to one or more alarm groups by checking the appropriate boxes.

Alarm Disable

Alarms for any master communications failures can be disabled by checking this box. This disable is retained through a unit reset or power cycle.

Slave Status

The status of slave communications from any masters over cellular is displayed in this section.

Xmits and Rcvs

A pair of statistical counters is maintained for Ethernet port slave communications, counting the number of messages successfully received and responses transmitted. The counters are 16-bit and "roll over" when they exceed their maximum value of 65535.

Status and Fails

The cellular port has a Slave Watchdog Timer (described above). When set, the module can determine if a cellular slave communications failure has occurred when a message is not received at least as frequently as the Slave Watchdog time setting. The current state of cellular slave communications is displayed as the "Status" while a count of the number of times that slave communications has failed is displayed just below it.

Max(S) and Last(S) Latency

The module maintains statistical counts on the time between messages received from any masters via cellular. There are counts displayed for both the maximum and last time values.

Source and Dest(ination)

These values show the address of the last device from which a message was received (Source) and if applicable retransmitted or repeated messages (Dest). These values only apply to the SDX protocol.

Clear

Click on the button to clear the statistical counts for cellular communications.

Ext. Cell

An external cellular modem option Messenger Cellular Router model 98-131(3/4) over Ethernet may be utilized instead of an internal cellular option for sending text messages and providing Internet access with the Messenger Cellular Router acting as a gateway.

Config

Enable

Check this box to enable the communication to the Messenger Cellular Router.

User Name / Password

This is the configuration user name and password as setup in the Messenger Cellular Router.

Old Message Timeout (M)

When a text message is received, its internal timestamp is compared to the time in the module. This value sets a limit on the how late (or early) the message can be and still be accepted. This is especially important if text messages using the STM protocol are being used to initiate control actions.

Accept Only Known Contacts

Check this box to have the module only accept incoming e-mails from known contacts in the alarm contacts list (see Alarming/Notifications tab)

Status

RSSI

The strength of the receive signal is displayed here in -dB. Typically, this will range from about -40dB for an extremely strong signal, to about -100 dB for a weak signal. Signal strengths of less than -100dB can be sometimes provide some communications, but should be corrected for reliable operation.

Cellular Number

This is the telephone number assigned by the cellular carrier. This number is used to identify the account as well as the number for text message communications. The cellular number is stored in the SIM card, so the existence of the number does NOT confirm that a link has been successfully established to a cell tower.

Cellular IP

This is the IP address assigned by the carrier for data communications over the Internet. Whether the account is assigned a static or dynamic IP address, it is passed down from the cell tower and not stored in the SIM card.

Last Cell Number

This is the telephone number from which a text message was last received.

E-mail

With Internet access, Modulus I/O modules can use e-mail to send out and optionally acknowledge alarms as well as send out reports and notifications. This section is used to configure the parameters required to communicate to a SSL/TLS e-mail server. A version of firmware is available that supports Ethernet IP, this version does NOT support SSL/TLS servers.

Email Setup Guides are available for [GMAIL](#), [Yahoo](#), & [Microsoft Servers \(Outlook / Hotmail\)](#) .

General

Mode

On cellular units only, this selector is available to choose whether Emails are transmitted over the Cellular Data or over the Ethernet interface. The default is Ethernet.

SMTP

SMTP is the protocol used for outgoing e-mails.

Server Address

Enter the IP address (or name if you have configured the module to use DNS) of your SMTP server.

Account, User Name and Password

These are the credentials used to log into your SMTP server. They are typically set up when you establish the account.

STARTTLS on Port 587 (Microsoft Servers)

Check this box if your e-mail service provider uses port 587 for SSL/TLS SMTP.

POP3

POP3 is the protocol used for incoming e-mails typically used for alarm acknowledgement.

Server Address

Enter the IP address (or name if you have configured the module to use DNS) of your POP3 server.

User Name and Password

These are the credentials used to log into your POP3 server. They are typically set up when you establish the account.

POP3 Test

Click on this button to test your POP3 configuration. You will see status messages go by at the top of the screen.

POP3 Poll Time (M)

This sets how frequently the module checks for incoming e-mail.

POP3 Alarm Poll Time (M)

When there is at least one active alarm, you will probably want to have the module check for incoming e-mails more frequently. This parameter sets how frequently the module checks for incoming e-mails when alarms are active.

Accept Only Known Contacts

Check this box to have the module only accept incoming e-mails from known contacts in the alarm contacts list (see Alarming/Notifications tab)

FTP

With Internet access, Modulus I/O modules can use FTP (File Transfer Protocol) to send files to a designated server. The transfer can be initiated automatically at set times and intervals, triggered by a program, triggered by an incoming file transfer (such as an image from a camera) or initiated manually. This section is used to configure the parameters required to communicate to transfer files from a Modulus module to an FTP server.

FTP Client

Server Address

Enter the IP address (or name if you have configured the module to use DNS) of your FTP server.

Server Path

Enter the path on your FTP server to the folder or directory that is to receive the files from the module.

User Name and Password

These are the credentials used to log into your FTP server.

Use Cellular Data

On Cellular units only, checking this box will cause FTP Client operations to go out over the Cellular Data interface.

Mode

This is a selection list to select how files are stored at the destination server. When the module initiates a file transfer, it can either create a new file each time overwriting a previous file with the same name, create a new file with a timestamp appended to the back of the file name to make a new unique file, or append the file to an existing file with the same name.

Preface Filename With Unit Name

By checking this box, the unit name is appended to the beginning of the filename when files are transferred. This allows the files from multiple modules to be deposited into the same folder without overwriting each other or other conflicts. The unit name is configurable under HMIs|GENERAL.

FTP Trigger Interval

FTP transfers of log files can be initiated periodically by selecting a time interval in this selection list.

FTP Starting Hour

If a periodic transfer interval is selected, the starting hour in the day can be selected in this list.

FTP Trend Data Select

If historical trend data is to be transferred, you can select if the data for all trend groups is sent or just a single individual group.

Trend Log Resolution

The historical trending function records data at 1 second or 8 second intervals. This can make for a fairly large amount of data. If less resolution is needed in the data to be transferred, a lower resolution can be selected in this list to reduce the amount of data to be sent.

Trend Log Days Back (0=Since Last)

Historical trending storage can retain years or even decade's worth of data. The amount of data to be sent can be limited to a number of days back at the time of transmission. If this value is set to 0, the data that has been collected since the last transmission of trend data will be sent.

Alarm Journal

When an FTP data transfer is triggered the Alarm Journal can be included. This list enables selection of the entire journal or just the information that was added since the last transfer.

Event Log

When an FTP data transfer is triggered, the Event Log can be included. This list enables selection of the entire log or just the information that was added since the last transfer.

Custom Event Log Filename

A Custom Event Log filename can be entered here. If using this feature the file will be sent in Append to mode using the filename as entered.

FTP Test

Click on this button to manually trigger an FTP test transfer.

File Pointer Reset Buttons

File pointers for the Trend Log, Event Log and the Alarm Journal keep track of the last data that was sent by FTP file transfer. These pointers can be reset by clicking on these buttons.

FTP Server

The Modulus module can also be a FTP server. There must be a SD card present for this server to work, as the files are stored and retrieved from it. Use the security tab to setup users to be able to log into the server.

FTP Server Enable

Click on this box to enable the Server.

FTP Ethernet Port

The standard control port for FTP transfers is 21 for control and 20 for data. This can be changed here. The data port is set to one less than the control port address.

Allow Anonymous Logins

Click on this box if login credentials are not required.

FTP Server Relay

Click on this box if the module is to relay (retransmit) files that it receives by FTP. The typical use for this feature is to retransmit snapshots and video clips received from an Ethernet camera.

FTP Last Name

The name of the last file received by FTP is displayed here.

C Drive File Purge

The C Drive is the optional micro SD card "disk" drive of the module. If snapshot images and video clips are automatically transferred to the module from one or more Ethernet cameras, the memory card can end up with quite a large number of image files. A facility is provided to delete files of certain types and ages to remove them in bulk. When configured, the Purge will take place each day at 1:00 am.

Purge Extensions

Enter the filename extensions of files to be deleted, separated by commas. The word "ALL" can be used to delete everything from the C drive that is older than the setting below.

Days Older Than

Only files older than this setting in days will be deleted. This values range is 1 to 3652.

Purge Now

Click on this button to remove all files that fit the selection criteria above.

MQTT

MQTT is a Publish/Subscribe protocol used for Internet of Things (IoT). It allows the publication of local data and subscription to remote data through an MQTT server called a Broker. This can be accomplished via the Internet, Ethernet, or Cellular if these interfaces are available on the unit. Publish and Subscribe Events are setup in the Destinations and Events pages and may be configured for binary or ASCII transmission of data. Subscribe events only support binary or STRING_BUFFER ASCII data for M2M interfacing.

MQTT protocol when activated maintains a connection to the Broker so that any subscribed events may be received. The Broker publishes other unit's "Publish" events to any unit that subscribes to that topic.

The MQTT protocol also supports RETAINED published events so that units that do not remain connected may publish data and subscribing units can get that data even if they are not on-line at the time the data is published.

MQTT may also utilize packet encryption to the Broker when a unit has encryption available.

MQTT is also the interface that the SparkPlugB protocol uses to communicate to an Ignition SCADA system Broker with different rules for defining the “topics” used. SparkPlugB Destinations handshake with the Broker and publish the register tag names, configurations and time stamps so the proper data types show up in the SparkPlugB Broker which then in turn gets published to the Ignition SCADA system automatically with last updated times as well as communication status.

MQTT / SparkPlugB Destination String and Event Tag Special Configuration

In MQTT, publishing data from the unit requires at least one MQTT Destination and one MQTT Event set to “Poll” or triggered from programming. The MQTT topic published will be the <Destination String>/<Event tag>

Destination Strings and Event tags can contain other text within square brackets “[text]” and multiple sets of brackets may be used. It should be noted that there are 40 characters available in the Destination String and 32 characters available in the Event Tag so the shorter the names the better.

For example, a Destination String may be “Hayward[/]DeviceOne[/Local_IO]” and the Event tag might be “Temperature”. The MQTT topic when published would be:

“Hayward/DeviceOne/Local IO/Temperature”.

There are special tags within the brackets that may be utilized but they must be in brackets by themselves.

- [#name] inserts the name of the unit.
- [#serial] inserts the serial number of the unit.

So the above Destination String could be “Hayward[/][#name][/][#serial]”.

The above Event Tag could be: “DeviceIO[/]Temperature”

The resulting MQTT published topic could be “Hayward/CELL/105154/DeviceIO/Temperature”.

In programming and web configurations, the square brackets and anything within them are removed from the Event Tag name reference. The Event Trigger register above for example, would be referred to as “DeviceIOTemperature” with _TRIG applied to the end of the Tag.

In SparkPlugB, the Event Tag is ignored (except for triggering) and the Tags of the register(s) that are “Connected” to the SparkPlugB server are used to identify individual values. They show up in the SparkPlugB server as Edge Nodes/ICL/[serial number]/[Destination String]/[Register Tag]. The Destination String bracket rules above apply and multiple Destinations may be used to classify groups of registers.

With the SparkPlugB protocol, there is a built in limit to the number of Events/Registers that may be applied to a single Destination group. This limit is checked on first connection to the SparkPlugB Broker when attempting to publish the Destination and all its Events for the first time. If the interface limit is

exceeded, an error "Too Many items in a SparkPlugB Destination" will be generated to show which Destination is responsible. In this case another Destination will need to be configured and Events will need to be rearranged to accommodate the data across multiple Destinations. The limits vary due to data sizes and tag name lengths so some experimentation may be needed to get the right configuration for all of the data desired.

Config

This section defines the connection to the MQTT or SparkPlugB Broker.

Broker Address

This address is the public IP or domain name address (DNS server must be configured) followed by a : and the port number. It should be noted that different Brokers have different port numbers depending on whether encryption is used or not. If the “:port” is not specified after the address then port 1883 is used for TCP and port 8883 is used if encryption is implemented.

User Name/Password

Most public Brokers require a user name and password. This is supplied when the MQTT account is setup on a public broker.

Use SSL

If encryption is available on the unit, check this box to enable using encryption to the Broker.

Use Cellular Data

On a cellular unit, check this box to use the cellular interface to transact with the Broker.

Publish

This section defines general parameters for Publishing to the MQTT Broker or updating a SparkPlugB server.

Poll Timer (S)

Specify the rate in seconds at which any Publish or Connect Events marked for “Poll” will be published to the Broker.

Response Timeout (S)

This is the time to wait in seconds for a valid response from the Broker when establishing a connection. Once the Broker connection is established, Polled Publish Events and triggered Events will be transacted with the Broker.

Retry Count

This is number of attempts to try and connect to the Broker.

Add Units to Text Number

Allows Published N, UI or AO events to add any available Units string to the text for any non-binary Publish event. For SparkPlugB, a Units string configuration will be added to the Tag published.

Boolean Verbiage

MQTT Events can be configured to Publish ASCII words instead of 1's and 0's when Publishing Boolean values from B, DI and DO registers. There are eight different Verbiage(x) pairs that have customizable ON and OFF text. That customization is done here. When Publishing via Events, Select Publish <Registers B, DI or DO type> Verbiage(x) to use the correct On/Off pair of words.

Verbiage (x) On / Off

This is the On/Off text of up to eight characters to be displayed when the register state is published.

Satellite Server

The Satellite Server can be used to communicate with remote units that have satellite modems attached to them. The Server uses Ethernet to send and receive messages.

Satellite Server (Outgoing To Remote Satellite Modems)

This section defines the configurations to send messages to a remote Satellite through a Server.

Server Address

Enter the IP address (or name if you have configured the module to use DNS) of the Satellite server. This will probably need to be "rockblock.rock7.com".

User Name and Password

These are the credentials used to log into the Satellite server. They are typically set up when you establish the account.

Poll Timer (s)

Specify the rate in seconds at which any Write Events marked for "Poll" will be sent to the server.

POP3 (Incoming From Remote Satellite Modems)

POP3 is the protocol used for incoming e-mails. The Satellite server will send out an email whenever it gets a message from a Satellite modem.

Server Address

Enter the IP address (or name if you have configured the module to use DNS) of your POP3 server.

User Name and Password

These are the credentials used to log into your POP3 server. They are typically set up when you establish the account.

POP3 Test

Click on this button to test your POP3 configuration. You will see status messages go by at the top of the screen.

POP3 Poll Time (M)

This sets how frequently the module checks for incoming e-mail.

Routing

Routing enables access to devices connected to any Ethernet port on any module in the system from any module's Ethernet port over the high-speed Modulus "backplane" to any other module's Ethernet port. For example, a single module port may have a public static IP connection to the Internet. Ethernet devices such as PLCs, VFDs, etc. connected to ports on any other modules on the bus can be set to be accessed by configuring the routing parameters here.

Note that the Modulus bus is optimized for real-time control, so data intensive applications such as streaming should be avoided.

Listen Port

This is the address of the port that device information (requests, etc.) will come in on. For example, 8080 is frequently used as a secondary port number to access web pages in a routed device (since port 80 is already "taken" by the Modulus module itself). This can then be routed to port 80 at the destination module's Ethernet port. To access the web pages at port 80 in that device, you would use <module IP address>: 8080 in your browser.

Routed IP

This should be set to the IP address of the target device that you want to route to.

Destination Slot

This should be set to the slot address of Modulus module that the target device is connected to.

Routed Port

This should be set to the port number in the target device that the messages are to be routed to (such as port 80 in the example above to access the device's web pages).

Master Destinations

Master Destinations define up to 32 devices that a module will initiate communications with as a communications master. Each definition includes a custom tag name, a selection of the protocol to be used, addressing information, comm fail alarm configuration and repeater hop definitions associated with getting messages to and from that destination.

(Destination) Tag

The Tag is a configurable name for each Destination. All Destination Tags may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default destination name is Destx where x is a number between 1 and 32.

Protocol

This is a selection lists with available protocols for mastering over Ethernet and serial links. Ethernet protocols include:

- SDX (Secure Data Exchange) with AES 128 encryption
- Modbus TCP and UDP
- Ethernet IP (when supported)
- MQTT

- SparkPlugB
- Satellite Server

Serial communications protocols supported may include:

- SDX (Secure Data Exchange) with AES 128 encryption
- Modbus RTU
- DF1
- SDI-12 (when supported)
- Satellite Com1 (when supported)
- Ultrasonic (when supported)

Cellular communications modules support all of the above plus:

- Cellular SDX (Secure Data Exchange) with AES 128 encryption
- Cellular Modbus TCP and UDP
- Cellular STM (encrypted register communications using text messaging)
- MQTT
- SparkPlugB

Disable Checkbox

Checking this box for a destination disables communications to it, primarily for diagnostic purposes. This disable is retained through a unit reset or power cycle.

Destination (String)

For Ethernet communications enter the Destination IP address or name (if you have configured a DNS server address under COMMUNICATIONS|ETHERNET or COMMUNICATIONS|CELLULAR). In cellular communications modules, a phone number is entered here for STM text messaging communications. In MQTT, this is the primary Topic Name for any Events that use this destination. For SparkPlugB, this is used as a “Device” name under “Edge Nodes/ICL/[serial number]/[Destination String] and any Events connecting to the SparkPlugB server will go under that “Device”.

For MQTT Configuration see [MQTT / SparkPlugB Destination String and Event Tag Special Configuration](#).

ID

This is the unit address. For Modbus, this can be a number between 1 and 255. For SDX, the number can range from 1 to 65535. For SDI-12, addresses from 1 to 10 are supported.

When using Ethernet such as Modbus TCP and UDP as well as Ethernet SDX, the unit address is necessary in addition to the IP address specified in the Destination (String).

Port Override

Protocols that use Ethernet have a default or "normal" port number associated with that protocol. For example, Modbus TCP or UDP generally uses port 502. The default port for a protocol can be overridden by entering a value in this field. Serial SDX also uses this field to redirect messages over the backplane using IOX.

Comm Fail (S)

Communications failures can be detected by sensing that a message has not been received for a settable time period. To detect received communications failures, enter a time period here (in seconds). A value of 0 disables this.

Comm Alarm Groups and Disable

The module can sense a communications failure for each individual destination by sensing a failure to receive responses to mastered messages (see Response Timeout and Retry Count for the port being used). If a communications failure is detected, an alarm can be initiated to one or more alarm groups as selected by a set of 8 check boxes. Alarms for a particular destination can be disabled by checking the destination's AlmDis box.

Hop1 and Hop2

Serial SDX protocol supports message repeating for access to specific destinations that cannot be "reached" directly. The addresses of the intermediate "hops" are entered in these two fields.

Master Events

Master Events are the actual data transactions that are to be performed with each destination. All transactions handle exchanging data in blocks of sequential registers in a remote device, in and out of local B and N registers in the module. Both polled and "triggered" operation is supported. There can be a total of up to 128 Master Events.

Tag

The Event Tag is a configurable name for each Master Event. All event names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default event name is Comm_Eventx where x is a number between 1 and 128.

If manually triggering a Master Event, this tag name may be used in programming by setting the <tag name>_TRIG to true. This flag will be automatically reset when the event completes.

This flag should be SET to true then left alone for the system to see it and act on it and then reset when complete. For example:

' Correct example sets then trigger when the delta activates then leaves the flag alone
If delta(1, Pump1_On_Setpoint) then WritePump1SP_TRIG = 1

' In this example, the delta sets the flag one time but will reset it on subsequent program scans
' This will result in the _TRIG being missed by the Master Communications Engine

WritePump1SP_TRIG = delta(1, Pump1_On_Setpoint)

If you using FBD/Ladder Logic, use a SET –(S) coil to fire off the _TRIG flag, and do not use the WRITE –() normal coil or the same issue as above will result.

For MQTT Configuration see [MQTT / SparkPlugB Destination String and Event Tag Special Configuration](#).

Destination

A selection list of the 32 Destinations defined under the Master Destinations tab described above.

Trig

This button / indicator shows if an event is triggered. The indicator will go out when the event has completed (or error out). Pressing it will trigger the event.

Message Type

Every Destination has a protocol associated with it. When a Destination is selected, a selection list in this field automatically displays the appropriate and possible message transactions for the protocol.

Generally these transactions pass numeric and Boolean data between a destination device and the N registers, B registers, and I/O of the module. Both 16-bit and 32-bit modes are supported for numeric data exchanges.

Poll

Check this box if the event should execute periodically at the polling rate defined for the port being used. Uncheck it to strictly use triggers in the programming section to initiate Master Events.

Local, Remote and Block Size

The Local and Remote field define the starting registers in the module (Local) and the starting registers in the remote device (Remote) for transfer of a block of data for this event. Block Size is the number of registers to be transferred each time the event executes.

Dynamic DNS (DDNS)

When a Modulus module is connected into an Ethernet or Cellular network, it may not have a fixed (static) IP address. Instead, the IP address may be “leased” to it (using DHCP) and it may change at any moment. This can make it very difficult to utilize important server features such as the register communications, Web User Interface, Mobile Interface, Reports and remote configuration support if you don’t know the IP address of the unit at any given time. To solve this type of problem, there are (Dynamic DNS) services on the Internet that provide a Name-to-Address lookup function that allows the address to change relatively frequently but maintain a consistent Internet domain name. When configured, the module updates the DDNS server whenever it is leased a new address, and users utilize a name instead of an address to access the Module.

To take advantage of the Dynamic DNS feature, you will need a free (or low-cost) account on a Dynamic DNS server. Modulus modules have been tested with two different DDNS services: **No-IP.com** and **DynDNS.com**.

DDNS Enable

A control to enable Dynamic DNS for Ethernet or Cellular access in comm modules with a built-in cellular modem option.

Hostname

Enter the name that will be used to access the module as set up when you established an account with the DDNS provider. An example would be “Modulus.no-ip.com”

Username

Enter the username that you set up when you established the account with the DDNS provider. Typically, this is your e-mail address.

Password

Enter the password that you set up when you established an account with the DDNS provider. Be careful; the password is normally case sensitive.

Server Address

Enter the address of the Dynamic DNS server. This will be provided to you when you sign up for an account. For example, for the no-ip.com service, the address is: *dynupdate.no-ip.com/nic/update*.

Test

Click on this button to have the module immediately send an update to the Dynamic DNS server. Look for responses (“Response Code”) on the status line at the top of the page.

For additional information on setting up a Dynamic DNS server link, contact ICL technical support for a more detailed application note for using either no-ip.com or DynDNS.com.

Serial File Transfer

This is used to send firmware, libraries and Backup images to a remote unit with a Serial “SDX” connection. This also can retrieve logs from the remote unit. You will need to setup at least one Serial SDX master destination before this page will populate. A SD Card is also required for this functionality.

Modulus Model Information

A remote model can be queried to see some basic information about it. This information can be used to determine what firmware needs to be sent if any.

SDX Dest Selector

This is a selection lists with available destinations that have Protocols set to Com1(2) SDX. If the destination is properly setup and connected, the information will be displayed. If not then "Error: Unit did not respond!" will be shown. You can press the Query button if you want to try again. Changing a selection will initiate a query automatically.

Operation: Abort

Click on this button to abort any transfer that is in progress.

System Log: Full

Click on this button to download an entire System Log from the selected destination. The file will be displayed below and have a filename of "SystemLog_<name>_<SN>_<DATE>_<Time>.logS". This file can be Displayed or Downloaded by pressing the buttons next to it.

System Log: Last

Click on this button to download entries made to the System Log since the last time that it was downloaded.

Alarm Log: Full

Click on this button to download an entire Alarm Log from the selected destination. The file will be displayed below and have a filename of "AlarmJournal_<name>_<SN>_<DATE>_<Time>.logA". This file can be Displayed or Downloaded by pressing the buttons next to it.

Alarm Log: Last

Click on this button to download entries made to the Alarm Log since the last time that it was downloaded.

Event Log: Full

Click on this button to download an entire Event Log from the selected destination. The file will be displayed below and have a filename of "EventLog_<name>_<SN>_<DATE>_<Time>.txt". This file can be Displayed or Downloaded by pressing the buttons next to it.

Event Log: Last

Click on this button to download entries made to the Event Log since the last time that it was downloaded.

C Drive (SD card)

The files listed below are stored on the micro SD card if it is inserted, formatted and mounted. Clicking on a filename will open the file.

Add File: <browse>

Click on the browse button to select a file to be transferred from your computer to the micro SD card flash disk in the module. You can also simply drag and drop the file on to the browse button.

Filename, Date and Size

The names, creation dates and times, and sizes of the individual files stored on the internal flash disk. The file names are Windows compatible and can be up to 260 characters long. The filenames cannot include:

- slash (/) or (\)
- question mark (?)
- vertical bar (|)
- right angle bracket (>)
- left angle bracket (<)
- colon (:)
- asterisk (*)
- quotation mark (")

Del

Clicking on these buttons deletes individual files

Restore to Selected Destination

Clicking on these buttons will transfer a backup file to the selected destination and then restore the backup.

Send to Selected Destination

Clicking on these buttons will transfer a firmware (.SFS) or library (.wfs) file to the selected destination.

Display

Clicking on these buttons will decode the log files and display the log in the browser.

Download

Clicking on these buttons will decode the log files and download the log to your local computer.

Alarming / Notification

All Modulus modules can initiate, record and annunciate alarm conditions as well as send out triggered or periodic notifications. Alarms can control local outputs to turn on annunciators as well as send e-mails and text messages (via e-mail). Any module can act as an alarm server and/or client. As a server, the module can receive alarms over the bus from other modules in the system, and annunciate them just like any local alarm. Essentially, the alarm server acts as an "alarm concentrator" providing a single point to display and acknowledge all alarms in the system. As a client, a module is configured to broadcast its alarms on the bus to be picked up by one or more alarm servers. For example, when a Modulus Cellular Communications Module is used as an alarm server, it can receive alarm broadcasts by other (client) modules on the bus, annunciating and acknowledging them via cellular. Acknowledgements are passed back to the initiating client.

Status

The Status tab displays all of the current alarms, their states (active unacknowledged, acknowledged, and idle), when they first occurred, when they were acknowledged and when they cleared. Alarms are configured to be associated together in groups by similar functionality; i.e. security, maintenance, etc. The Status display can be set to show all alarms or just specific groups.

Fire Test Alarm

Click on this button to initiate a test alarm to all groups.

Delete Cleared Alarmed

If configured to do so, the status of alarms is shown even if they have been cleared. This allows you to see the full sequence of time stamps; when initiated, acknowledged and cleared. Clicking on this button removes all cleared alarms from the displayed alarm grid.

Ack Alarms

Click on this button to acknowledge all currently active alarms.

Refresh

Click on this button cause an immediate update of the alarm status screen.

Show Cleared Alarms

Check this box if you would like alarms to be shown in the alarm grid even after they have been cleared.

Alarm Group En (1-8)

Click on the boxes for the alarm groups that you wish to see in the alarm grid. This only affects the display of the alarm in the alarm grid, not their activation and annunciation.

Alarm Grid

The Alarm Grid shows the status of all alarms; Active Unacknowledged, Acknowledged and Cleared. Active Unacknowledged alarms are displayed with a red background, Acknowledged alarms have a yellow background, and Cleared alarms have a green background. The time stamps for all three states are displayed in separate columns.

Besides being displayed here on the Status page, the Alarm Grid is a control that can replicate this display on a Web User Interface HMI page.

Config

Items under the Config tab customize the alarming operation of the module.

General

ACK All Alarms with DI

Use this selection list to choose a local Digital Input that can be used to acknowledge alarms.

ACK All Alarms with B Reg

Use this selection list to choose a B (Boolean) register that can be used to acknowledge alarms. This allows alarms to be acknowledged by communications with remote devices.

Common Alarm Output

Use this selection list to choose a local Digital Output or B (Boolean) register that the module will turn on when there is an active alarm in any group.

Alarm Header

Enter a text string that will precede any alarm name from this module to help identify the alarm source. The text may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character.

Re-alarm Timer (M)

When an alarm is acknowledged but doesn't get cleared for an extended period of time, the module can re-initiate the alarm. This value sets the time period in minutes that the module will wait to re-initiate previously acknowledged but not yet cleared alarms.

IOX Client Enable

Check this box if this module is to broadcast its alarms over the bus to one or more alarm servers.

IOX Server Enable

Check this box if this module is to receive any annunciated alarms broadcast over the bus, and pass alarm acknowledgements back to the initiating client modules.

Alarming

Alarming Retry Timer (S) and Alarm Retries

If an active alarm is not acknowledged in the time specified here, the alarm is re-annunciated. This is repeated for the number of retries specified.

Allow Off Schedule Acks

Check this box to allow users that are not on the contact list or within their schedule times to acknowledge alarms.

Enable Cleared Reports

Check this box if you wish for the module to annunciate when alarms clear.

Enable Active Alarms in Cleared Reports

Check this box if you wish for the module to annunciate active alarms whenever cleared alarms are annunciated.

Include Active Alarms In Cleared Reports

When sending an alarm report, include any currently active alarms with the Alarms that are cleared.

Alarm Call Group Select

Select whether the contacts set as "normal" or "holiday" are to receive alarm notifications.

Alarm Group Auto Acknowledge (1-8)

Particular Alarm Groups may be selected to “Auto Acknowledge” after any alarms associated with that group are actuated. If annunciation includes text messaging, email or some other reporting, the acknowledge will happen after any associated annunciations have completed.

Daily Alarm Site Check-in

To ensure the integrity of the alarming system, if there have been no alarms annunciated, the module can be configured to send out a daily "check-in" message.

Hour to Send Message

Use this selection list to choose when the check-in message will be sent out.

Skip if Alarmed in Last 24 Hours

Check this box if you wish for the module to not send out a check-in message if there has been an alarm annunciated in the last 24 hours.

Alarm Group En (1-8)

Check the boxes for the alarm groups that are to receive check-in messages.

Periodic Report

The module can be configured to periodically (or by programmable trigger) send out a report to any or all of the alarm contacts. For example, the module can be set to automatically send out a shift production report every 8 hours or a plant daily production report every 24 hours.

Starting Hour

Use this selection list to choose when the first automatic report of the day should be sent out.

Trigger Interval

Use this selection list to choose how often automatic reports should be sent out. This can be set to intervals of every 10, 20 and 30 minutes, or 1, 2, 4, 8, 12, or 24 hours. Reports can also be initiated by a trigger from a logic program.

Alarm Group En (1-8)

Check the boxes for the alarm groups that are to receive automatic reports.

Include Report

Use this selection list to choose which report (on the internal disk drive) is to be sent out.

String Notification

The module can be configured to send out a custom message from programming to any or all of the alarm contacts. The message is created in the String_Buffer register. Then when the String_Notification_Trigger is set, the message will be sent out in the body of the message. In email notifications, the subject will by default include text "Notification" and the unit name. To customize the email subject, place the custom subject text followed by a semicolon delimiter in front of the notification text in the String_Buffer register.

Alarm Group En (1-8)

Check the boxes for the alarm groups that are to receive String Notification message.

All Alarms

Alarm

The name of every possible VISIBLE alarm in the module including Digital Inputs, B registers and system error registers.

Alarm Group En (1-8) and Alm Dis

Check the boxes for the alarm groups that each alarm is to be associated with. For example, you might designate alarm group 1 to be for security alarms, alarm group 2 for maintenance alarms, etc. An AlmDis (alarm disable) checkbox is also provided to momentarily disable individual alarms when checked.

Alarm Group Tags

These are user settable names for each alarm group. They may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default name is AlarmGroupx where x is the group number from 1 to 8.

Contacts

Contacts are the list of names and cell phone numbers/e-mail addresses that the module will send alarms and notifications to. The list is also used to validate users when access to the module has been limited to "known users".

Schedule

Contact

A selection lists of available contacts (cell phone numbers and/or e-mail addresses) that alarms will be sent to.

Alarm Group En (1-8)

Check from 1 to 8 boxes for the groups of alarms that will be sent to the selected contact.

Start and End Times

Set the time period of the day that alarms and notifications can be sent to this contact. Setting both times to 0:00 (midnight to midnight) means 24 hour coverage.

Su Mo Tu We Th Fr Sa

Check the boxes for which days of the week that alarms and notifications will be sent to this contact.

Holiday

The alarming and notification system can be placed in either "normal" or "holiday" mode under the **Alarming/Notification|Config** tab or by controlling the Alarm_Call_Group_Sel variable in the programming environment or the HMIs. This selector makes it easy to shift the alarming and notification schedules for coverage over a holiday or other time period which does not lend itself to just a plain time and day-of-the-week format.

Elevated

Check this box if the contact is to ONLY be reached if an alarm has been annunciated but not acknowledged after the configured number of alarm retry attempts (see Alarming under the **Alarming/Notification|Config** tab).

Report Editor

The Report Editor provides a convenient built-in web-based tool to create and edit reports in the module. You can use an external editor, but using the built-in editor is recommended, especially if you want to take advantage of the enhanced capabilities using HTML and CSS formatting.

Note that the Report Editor requires that "pop-ups" are enabled if you wish to preview reports. Most browsers allow for you to selectively enable pop-ups by address, so if you like, you can just enable them for access to the controller web pages. Also, note that the Report Editor requires a device with a mouse. This is one of the few cases where a tablet or smart phone may not be used for module configuration.

All reports are stored on the internal flash disk "B" in the module. The reports can be text based and saved with the ".rpt" extension or HTML formatted and saved with the ".htm" extension. Graphics can be added to the formatted reports. These reports can be processed and sent out as text messages or emails with the Periodic Report Notification system or can be run by directly accessing them from a graphical HMI. Only .rpt files can be used with text messages.

Reports can have trend data, System Log, Event Log, and/or Alarm Journal info added into the report as formatted tables. When emailing a report this data is stored as attachments and not included into the report. When using the text based reports, the table data is comma delimited text.

From a Graphical HMI reports can be assigned to "Get Docs" buttons and run by pressing the button. Also text based ".rpt" reports can be assigned to "HTTP Link" buttons using the link "/b/<report>.csv" where the ".csv" is replacing the ".rpt". This is useful when a user wants the report to be shown in excel.

Besides the text area itself, there are various tools and selection lists available to create attractive and effective reports.

The editor is a standard text editor with a few enhancements.

Ctrl-C and **Ctrl-V** copy and paste functions are supported in the report editor so you can copy text from another source on your PC and paste it into a report document.

Non-printing comments are included as text with a single quote in the first position. Comments are displayed as green text.

File Access Pull-down Menu

Report documents can be stored and retrieved to and from your local storage in addition to the controller itself. If you hover your mouse over the black square in the upper left hand corner, the selection box with four buttons appears.

Report Load Source

Click on this button to retrieve a copy of a report from your computer.

Report Save Source

Click on this button to save a copy of a report on your computer.

Print Report Source

Click on this button to print the source code of the report which is currently loaded in the editor.

Report Storage Selection (in the module)

Reports may also be stored and retrieved from the local "B" flash disk in the module. Plain text reports must have a ".rpt" extension. HTML/CSS formatted reports must have a ".htm" extension.

Select File

This is a selection list of existing reports stored in the module. Use this list to open and edit an existing report.

New File

Click on this button to create and begin editing a new report file.

Report Editor Tools

A row of buttons near the top of the editor page are used to select the editor tools. Some buttons may be "grayed out" if they are not selectable at the time. Hovering your mouse over a button displays a "tool tip"—a short description of the button's function.

Back Arrows

Return back to the module configuration pages.

Home

Click on this button to return the cursor to the home (upper left-hand) position. This is a *shortcut to scrolling to the top of the document if you are editing an especially large report.*

Download

Compile the report and save it in the module. This button is enabled whenever a change in the report has been made (the report copy in the editor differs from the copy in the module).

Preview

Preview how the report looks in your browser. This is especially useful for .htm reports with special embedded formatting in the report.

Insert Styles

Click on this button to insert style information into a report including fonts, tables, backgrounds, etc. This button is only enabled when editing .htm report files.

Remove Styles

Click on this button to remove any style information in a line. This strips the line down to just the bare text and tags. This button is only enabled when editing .htm report files.

Search and Replace

Click on this button to find text or do a mass change to the text in your report.

Undo and Redo

Click on these buttons to undo or redo edits to your report.

Tag Selection Pull-down Lists

A floating bar near the bottom of the editing window has a set of selection lists with any tag names that have been marked as “visible” grouped into lists of related items. Selecting an item from one of these lists automatically inserts the tag name (within | brackets) into your document. For example, if you select a tag name called “tank level” from the {numbers} list, the editor will insert

```
|Tank_Level|
```

into your document. If you want to see all tag names in the lists regardless of whether they are visible or not, check the box on the left side marked “All”.

When the report is run, all of the tag names within brackets will be replaced with the current values in their registers.

Besides number register tags , boolean register tags and I/O tags, there are selection lists for internal bits such as comm fail flags, clock and calendar variables, pump controller variables, etc. as well as trend and event logs and the alarm journal.

Trend Data in Reports

The Trend Reports selection list is used to attach trend data to notification reports and to insert trend data into the body of all other plain text and HTML/CSS reports. You can select all or individual trend groups to be included.

Trend Data Filters

When a trend is selected from the pull-down lists, a filter selection window is displayed. This allows the data that is extracted from the historical data storage in the controller to be reduced to the most manageable levels as required for your application. The filter information varies depending on the “Report Type” selected at the top of the filter selection window. The report filtering is included as a “meta-tags” within “|” brackets in the report text. The report editor creates these meta-tags for you as part of the trend data tools when you select and configure a trend data filter.

Time From Now Filtering

Time From Now filtering extracts data back from the current time that the report is run. For example, if a 24 hour report is run at 1:30pm on a Tuesday, the extraction of trend data will begin with the data that starts at 1:30 pm on Monday. The filter allows you to select a reduced resolution in seconds, minutes or hours, going back a number of hours or days.

The meta-tag inserted for the example on the right: **|~TA,30S,168|**

TA means ALL trend groups. This will be T1 for just trend group 1, etc.

30S means 30 second resolution. This will be 30M for minutes and 30H for hours.

168 is the number of hours back. If you select “Days Back” in the filter, that number is converted to hours.

Daily Filtering

Daily filtering extracts data back one day starting at a specific hour. That means that regardless of when the report is run (within 24 hours), the extracted data will start at a specific hour on the previous day.

The meta-tag inserted for the example on the right: **|~T1,30M,D,2|**

- T1** means just trend group #1
- 30M** means 30 minute resolution.
- D** means "Daily" filtering
- 2** means starting at 2am (0 = midnight)

Weekly Filtering

Weekly filtering extracts data back one week starting at a specific hour on a specific day of the week. That means that regardless of when the report is run (within a week), the extracted data will start at a specific day and hour in the previous week.

The meta-tag inserted for the example on the right: **|~T2,1H,W,7,SU|**

- T2** means just trend group #2
- 1H** means 30 hour resolution.
- W** means “Weekly” filtering
- 7** means starting at 7am (0 = midnight)
- SU** means starting on Sunday

Monthly Filtering

Monthly filtering extracts data back one month starting at a specific hour on a specific day of the month. That means that regardless of when the report is run (within a month), the extracted data will start at a specific day and hour in the previous month.

The meta-tag inserted for the example on the right: **|~T6,12H,M,7,1|**

- T6** means just trend group #6
- 12H** means 12 hour resolution.
- M** means “Monthly” filtering
- 7** means starting at 7am (0 = midnight)
- 1** means starting on the first of the month (1 to 28)

Day of the Week Filtering

Day of the Week filtering extracts data back to a specific day in the previous week starting at a specific hour on a specific day of the month. That means that regardless of when the report is run (within a week), the extracted data will start on a specific day of the week and hour in the previous week.

The meta-tag inserted for the example on the right: **|~TA,15M,MO,8|**

- T6** means ALL trend groups
- 15M** means 12 minute resolution.
- MO** means “Monday” filtering
- 8** means starting at 8am (0 = midnight)

Event Log Data in Reports

The Event Log selection list (under Log Reports) is used to attach event log data to notification reports and to insert event log data into the body of all other plain text and HTML/CSS reports. Event Log data is written by a User Program. There is no set format for the data placed into the event log, but the preferred format for processing and exporting event data is CSV (Comma Separated Variable) which uses commas to delimit individual fields of ASCII data. If CSV format is used, the log data can be filtered to extract specific records and “columns” of data as required, reducing the total amount of data that needs to be transmitted or printed.

Event Log Data Filters

When the event log is selected from the pull-down lists, there are two choices of how the data is extracted; either as the entire log, or just the data that is new since the last report was run (usually a much smaller amount of data to handle). Within both of these selections, there is the option of additional filtering to extract individual records (lines) of like data types, as well as selecting individual “columns” of delimited data values.

Event Log Filtering

When the Even Log is inserted into a Report, the following configuration dialogue is displayed for configuring any filtering of the data to be extract.

If a tag character or word (only the first character of the first column is checked), is placed at the very beginning of each event record (line), then you can specify that only lines starting with a specific tag character are to be extracted. For example, you could use a p or the whole word “production” for production related data, s or “security” for security related data, etc. Then in the filter configuration, you would specify the applicable tag or “Records Character” to qualify a line to be included in the extracted data. Likewise, there are 16 check boxes to individually select individual delimited elements in the record (line), so only specific data columns are extracted. For example, if you use a tag or Records Character, but don’t want that to show up in the extracted data, you would simply make sure that the first column was unchecked. So in the example above, if a line of data in the event log was:

a, 01/25/15,10:26:04,55.2,128.6,24.5

then the extracted data would be:

01/25/15,10:26:04,55.2

Any line that didn’t start with the letter “a” would be eliminated as well as any data that was not in columns 2,3 or 4.

The meta-tag inserted for example above is: **|~E,'a',000E|**

~E means ENTIRE log (~L for last log data)

'a' is the tag or Records Character

000E is a bitmap in hex for the selected fields to be extracted

Images in Reports (.htm reports only)

The Images selection list is used to insert graphical images and pictures into the body of HTML/CSS reports (this list does not show up as an option for .rpt plain text reports). This makes it easy to add logos, site maps and pictures to any report. The images are any graphic files stored on the internal "B" disk drive. When an image is inserted into a report, you have the option of specifying the height and width of the image as well as its absolute position on the page.

Image Height and Width

If left blank, the image is inserted “as is”. Entering a value for either Height or Width will resize the image (in pixels).

Image X and Y Position

If left blank, the image is inserted below the last text entered just before it, justified to the left hand side. Otherwise, you can specify absolute location (in pixels). X is the horizontal position, Y is the vertical position.

The meta-tag inserted for example above is:

```

```

If all of the size and position fields are left blank, the inserted tag is much simpler:

```

```

Report Style Tools (.htm reports only)

When editing .htm reports, the editor provides a set of tools to apply and remove styles that dress up the look of the reports and improve their readability.

When you click on the Insert Styles button:

A selector window is displayed to choose the type of style information that you want to work with:

- Document
- Tables
- Window/Tab Title
- Text Style

When you click on a line and then the Remove Styles button, the style information in that line is removed. Use this tool before you apply a new style.

Document Style Tool

Document Style Settings

The Document Styles Settings window is used to select a background color or background graphic, and specify a default font and font size for the entire report. If none of the values are set, the background will be plain white and the font will be the default browser setting.

Document Background Color

Clicking on this selection brings up a color picker. Move the arrows on the right up or down to the basic color scheme that you want to use and then click on the color palette on the right for the specific shade. Clicking on the Document Styles Settings window (behind the picker) will close the picker window, and you will see a small sample of the color that you have chosen.

Document Background Image and Image Style

Clicking on “Background Image” brings up a selection list of the available graphics stored on the “drive(s)” of the controller. To avoid readability problems as a background picture, you may need to modify the image in a graphical editor to “dial it back” (lighten it) before you load it into the controller.

Under image style, you have three choices:

- Tile** Multiple copies of the image are pasted together as a background
- Full** The image is adjusted to fill the entire page
- Center** The image size is left untouched. The image is simply centered on the page.

Document Font and Font Size

Clicking on “Document Font” brings up a selection list of the available fonts. Below it, you can specify the font size. The font and font size that you select will become the defaults for the report. You will be able to set other fonts for specific lines in the report.

Tables

Tables can be an effective way of dressing up the presentation of trend or event log data.

Table Styling Tool

The Table Styling Tool enables setting borders, spacing between the data in the table cells and the borders, the table font, bolding, and alignment of the header and data in the cells of the table, and a highlighting background color for alternate rows in the table.

Border Width and Collapse

If the Border Width is set to 1 or greater, a border line is placed around each cell with a small space between cells. If the border width is 0 or blank, there is no border line (just a blank space). If Border Collapse is checked, the space between cells is removed.

Cell Padding

Cell Padding sets the spacing between the cell borders and the text within the cells.

No Cell Wrapping

Wider data in a cell will wrap to one or more lines (breaking at spaces between words) unless this box is checked.

Table Font and Font Size

This sets the Font Type and Size used throughout the table.

Note that some of the less common fonts (such as Ariel Bold) may not display with the same look between browsers. The “Default” selection uses whatever has been set as the standard font in your browser.

Header Text Bolding and Alignment

These settings provide control over the look and alignment of the column headers.

Alternate Row Coloring and Row Color

Use these settings to place a background color behind all rows or just alternate rows in the table making it more attractive and easier to read. The color is selected from a color selection palette adjusting the arrows on the right to get within the range of color desired and clicking in the window on the left to select the specific shade. Click off of the window to close it.

Row Text Alignment

This setting controls the alignment of the data in the columns (Left, Right, Center).

Window/Tab Title Tool

The Window/Tab Title Tool sets the name that is displayed on the tab or window of the report in a browser.

Text Style Tool

The Text Style Tool sets the font, font color, font size and bolding of text within a line in the report. To use it, highlight the text in the report and select this tool.

HMIs

Modulus I/O modules have three built-in Human Machine interfaces (HMIs):

- **Graphical** - A full graphical display with animation that shows processes running with real-time views of the process values and operation.
- **Mobile** - A non graphical interface for small screen devices such as phones and tablets.
- **Local** - A compact textual interface for the OLED front panel display

The tabs in this section contain the tools to create and tailor each of these HMIs.

General

The General Tab has controls and parameters that affect all of the module's HMIs

Allow Graphical HMI Access w/o Logging In

Many times it is desirable to secure access to the modules configuration pages by enabling log-in security and assigning users to specific security access levels. Setting this option skip the security log-in requirements to view the screens but not allow the modifications of values. This is typically the case where the HMI screens are used to display process information but not alter it. Check this box if logging in is not required to access the graphical HMI screens when security to the rest of the module web pages is enabled.

Web Interface

When a user logs into the module, the first page that they see can be either a graphical web page, a mobile device web page, or the modules default web pages including the configuration screens. A selection list determines what the user sees when they first log into the module.

Since the web pages may be accessed by both large screen and mobile devices, there are selectable modes that prompt for the type of web interface when the user first logs in (Mobile/Graphical selection), or the module automatically senses the type of device connected and displays the appropriate interface (Mobile/Graphical Auto selection).

Convert Underscores to Spaces

Primarily because tag names are used in the programming environment, they are not allowed to have spaces in them. This can make the tag names look awkward in the HMIs. Check this box to have the module convert underscores to spaces when the names are displayed in the HMIs.

Setup Page Poll Refresh(S)

Many of the module configuration pages display live data that is constantly refreshed. In a cellular environment, this can drive up the operating cost since cellular costs are typically driven by data usage. The rate at which real time data in the configuration pages is refreshed can be set here. One second is the default refresh rate. It is recommended not to make this parameter greater than 10 seconds as it will slow most interface processes such as downloading new program configurations. This parameter has no effect on WUI Runtime pages as the WUI has its own refresh rate.

Unit Name

This is a user settable name for the module. The name is displayed in a selection list in multi-module systems and makes it possible to distinguish between like type of modules in the system. The modules Unit Name may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default name is the module type such as "DI24" or "COMBO".

Display Timeout (M)

This control sets a limit on how long the OLED display is "lit" before going dark after the last interaction with any front panel button of any module on the bus. A value of 0 will leave the OLED display up forever. This is not recommended as the OLED displays have a limited display life.

Local HMI Auxiliary Write Enable, and Cycle Enable Switches

If the module is used in a windowed enclosure, the local HMI can be controlled by external switches while the display is viewed through the window. These selection lists and check box are used to select the "switch" inputs (including B registers whose data can come from other modules) that replicate the functionality of the switch on the front panel of the module but can be secured with a mechanical lock switch.

Keypad Size (Touch Screen Input this browser only)

This can be used to adjust the size of a Touch Screens keypad. The setting is stored in the local web browsers storage not in the module.

Suppress RTC Sync At Startup

When checked, the web browser will NOT ask to sync the systems clock to the local computer. The setting is stored in the local web browsers storage not in the module.

Display/Calculate in Degrees C

Check this box if module operations and displays should use degrees Celsius.

Graphical HMI

Modulus modules have a built-in high-resolution graphical HMI that provides a full color animated interface using any devices that have a modern web browser; from smart phones and tablets to laptop and desktop computers.

The graphical HMI, also known as the Web User Interface (WUI), is a powerful feature that provides overall system access including status and levels, set points, trends, alarms, reports, documents, and live video. No web page programming knowledge is required; drag and drop development makes screen creation very fast and easy.

The tools for building Graphical HMI screens are included under the Graphical tab. The tools will work with every major web browser.

Graphical Web Page Workbench

The Graphical Workbench web page consists of a set of controls tabs along the top, a selector and groups of controls from the built-in graphical elements library on the left hand side, and a web page layout area that fills out the rest of the page. A black square target in the far upper left hand corner provides access to editor controls when you hover your mouse cursor over it.

Editor Settings, Page Settings, and File Access

If you hover your mouse over the black square in the upper left hand corner of the editor window, a pull-down menu with selection buttons appears:

WUI Parameters

Use this button to access the general configuration parameters for the graphical HMI such as update rates, menu controls, background page color and page size, etc.

WUI Name

This is the name that appears at the top of the window or on the browser tab for the HMI.

WUI Scan Rate mS

This parameter sets the fastest rate that the HMI pages will update. Slower speeds can reduce data costs for cellular based systems.

Cell Scan Rate mS

This parameter sets the fastest rate that the HMI pages will update when using an internal cellular option. Slower speeds can reduce data costs for cellular based systems.

Link Timeout (Sec)

This parameter sets the longest time that the browser will wait for a response from the module.

Menu Font, Font Size, Attributes and Disable

For navigating multi-page HMIs, the module automatically creates a menu page selector (square box in the upper left-hand corner). These parameters enable modification of the menu appearance, or complete elimination if the designer prefers to use only their own navigation buttons on the HMI pages.

Show Full Website Link

On the automatically generated navigation menu, a link to the main user pages can be provided. Leave this link disabled to keep users from accessing any other pages other than the web HMI.

Page Color

The background color of the HMI pages can be customized (the default is white). Clicking on the color value brings up a color picker window as shown on the right. The arrows on the right should be set to the general color tone desired. Clicking on a spot on the gradient on the left picks a specific color. The hex RGB value of the selected color is shown at the bottom. It can be copied and pasted for color matching.

Snap to Grid

Set the grid size to simplify placement and lining up the HMI objects. The default grid size is 3 (pixels).

Auto Save (Minutes)

Until a design is downloaded into the Module, it only resides in your browser. The Auto Save feature automatically saves off a copy of the work in progress periodically (default is 10 minutes) to your local device storage.

Screen Width and Height

These parameters set the HMI page size. If set to zeros, the pages are auto sized to accommodate the content on the pages. The size of the screens can be fixed (in pixels) by entering non-zero values.

Show Invisible Registers

When configuring graphical elements on an HMI web page, animated elements are linked to registers in the module normally using a selection list of registers that have been marked as “visible”. This drastically shortens the selection list and generally makes it faster and easier to use. If you want to see all registers in these lists and not just the “visible” ones, set this parameter to “yes”.

Add/Edit Groups

Groups are used to organize HMI pages in the automatic selection menu. Like pages can be placed together under a group to make it easier for operators to use. This button is used to create, delete and name menu groups.

Add/Edit Pages

HMI pages have configuration settings for naming them, assigning them to groups for the automatic selection menu, security access level (for the entire page), a trigger to “pop” the page up based on a trigger event, and a background image or solid color.

Page Name

Page Names show up in the automatically created selection list menu well as the top of the browser window or tab.

Group

Pages can be assigned to one or more groups to organize them in the automatic selection list menu.

Sec(urity) Level

Modulus modules support 32 levels of access security. If the module is configured to require a security login, then each user is assigned a specific security level. The page security level configuration setting will restrict access to that page to only users that have a security level equal to or greater than the page security configuration setting.

Trigger Reg(ister)

A page can be made to “pop up” automatically when a Boolean is set or an analog register becomes non-zero. The Trigger Register parameter selects the controlling register for each page. This feature is frequently used for alarming.

Background (BG) Image, Mode, sizing and position controls, or Background Color

Each page can have a background image or color. To be selected here, the image must have been previously loaded “drive” in the module (see System | Files). The image mode can automatically size the image to the full page size, tile the image on the page, or scale it to the height and width settings and position. If no image is selected, a fixed background color can be set (default is white).

New Interface

Clicking on this button erases any existing HMI and starts a new one after a confirmation prompt.

Save/Load Configuration

WUI configurations can be saved and loaded from your local device storage. The directory path is whatever your browser is configured for downloads.

Config Pages

Clicking on this button opens a new window or tab in your browser with the first configuration menu page of the module.

Page Selection

Click on a button under Page Selection to open an HMI page for editing.

Graphic HMI Editor Tools

Along the top of the editor window are a set of buttons that control the basic editor functions such as cut/copy/paste, undo and redo, alignment, downloading, etc. Note that buttons that are not currently active are grayed out and disabled. For example, the "redo" button is disabled when an "undo" operation has not been done.

Back Arrows (return to the module configuration pages)

Use this button to get out of the Graphical HMI editor pages.

Download (Lightening Bolt)

Download the Web HMI Design to the module. This button is enabled whenever a change is made to the design.

Redraw (circling arrows)

Each time a control is edited, it is brought to the top level (front) to simplify working with it. The redraw button refreshes the HMI layout and re-establishes the proper “look” of the page.

Note: Do NOT use the browser refresh to do this refresh the display of your web page in process. You could lose changes that you have made if you have not saved them and they have not been auto-saved yet! With every edit, after 5 seconds, the browser automatically makes a copy of the current edit state. If you lose the page or move to the module’s configuration without downloading, you will be prompted: There are edits from a previous session!

Click OK to restore edits or

Click Cancel to restore from device.

If you click OK, your edits that were not downloaded will be restored. If you click Cancel, you edits remain in browser storage and the configuration last download is retrieved from the device.

Download and View

Download the Web HMI Design to the module and view the web page in a new window or tab. This button is enabled whenever a change is made to the design.

Undo (left swirling arrow)

Undo recent changes to the design.

Redo (right swirling arrow)

Redo recent undo changes to the design.

Edit Tools (Paper and pencil symbols)

Clicking on this button brings up a floating Tool Bar window with editing functions to select HMI controls and Copy, Paste and Delete them. On a desktop platform, it is usually easier to take advantage of the shortcut keys (as shown in parentheses), but on a device that has no control keys (such as a tablet), you can use this Tool Bar. The tool Bar can stay open and be moved to any place within the editor window while you are working on your design.

Alignment Tools (left-right arrows symbols with stops)

Clicking on this button brings up a floating tool bar window with alignment (and distribution) functions. The tool bar can stay open and be moved to any place within the editor window while you are working on your design.

By selecting multiple controls and clicking on one of the alignment buttons, you can get perfect alignment of controls in a column or row. At the bottom of the window are a pair of indicators that show the precise location of controls (in x/y pixels) when you click on them. The control location is always the upper left-hand corner of the control.

Size Matching Tools (two headed left-right arrow)

Clicking on this button brings up a floating tool bar window with size matching functions. The tool bar can stay open and be moved to any place within the editor window while you are working on your design.

By selecting multiple controls and clicking on one of the size buttons, you can get a perfect sizing match of multiple controls on a page. For example, if you are laying out a page for a tank farm, you can make all of the tanks have the same dimensions, or change all of their dimensions at one time, by:

- selecting the tanks (rubber band around them with your mouse)
- enter a width and height
- clicking on “Apply Size” button

Graphic HMI Library

The Graphic HMI comes with a complete symbol library for SCADA applications, including tanks, pumps, pipes switches, indicators, etc. Groups of these symbols are accessed using the library selector in the upper left quadrant of the editor window.

Control objects from the library are added to a page by dragging and dropping them from the library to the page. A control in the edit area can be deleted, moved in front of other controls, or moved behind other controls by double clicking the control and selecting the appropriate action. A control can be copied and pasted by single clicking on it to select it, then using Control/C and Control/V, or by holding the Control key while dragging the control to another location then letting go of the mouse button.

Editor Key Combinations

There are several key combinations that are helpful when editing a page:

- Control/Z – This will undo the last edit action.
- Control/Y – This will redo the last edit action.
- Shift/Arrow key – This will move the control one pixel at a time in the direction of the arrow key that you’re using.
- Control Shift Arrow key—This will size any control by one pixel Left—smaller width, Right—larger width, Up—smaller height, Down—larger height.
- Control Shift F—When multiple controls are selected, this will move each control in turn to the front temporarily without changing its actual position relative to the rest of the design. Clicking the double arrow refresh button will restore the controls to the originally designed order. This is useful for getting to a control’s parameter dialog should it be hidden behind other controls.
- Control A—Will select all controls on the current page.
- ESC key—Will deselect all controls.

Control Editing

Once a control has been placed on a page, double clicking or right clicking on it brings up a menu of parameter settings for that control.

Common Control Parameters

The following list details the most common control parameters shared by many of the HMI controls in the graphics library.

Register

The module register(s) controls the behavior of the control object that it is mapped to. In many cases, the register is named by its function, such as “Tank Level”. Some controls operate upon multiple registers using a starting register and a block size. The block size is the total number of registers including the starting register.

Clamp Min and Clamp Max

If enabled, the value shown on the web page will be clamped to these values, and any value from the mapped register that is over or under the settings will cause the displayed value to stay at the clamp setting until the mapped register falls/rises back into the range equal to or between the clamp settings. This is especially useful to limit value entries (displays can also be used for entering register values). Setting both of these limits to zero will disable this feature.

Scale In Min /Max and Scale Display Min/Max

The displayed value will be scaled according to the **scale in min/max** and **scale display min/max** settings. An example would be for an input that has a raw 4-20mA value (typically 4000-20000), but the preferred displayed value is in engineering units such as the level of water in a tank in feet. Setting both of these Scale In values to zero will disable this feature.

Integer Width

This setting defines the number of digits that will be displayed for an Integer portion (left of the decimal point) of a number. If the register value has more digits than the integer width setting plus the decimal places setting (below), the register value will be displayed as dashes.

Decimal Places

This setting defines the number of digits that will be displayed to the right of the decimal point to emulate real numbers when integers have an “imaginary” decimal point or limit the number of digits after the decimal place if the register is a floating point value. If the register value has more digits than the integer width setting (above) plus the decimal places setting, the register value will be displayed as dashes.

Font Family and Size

This setting for text allows the selection of the font type and size. Be sure to test the fonts with the browsers being used since some of the less common fonts are not supported by all browsers.

Label Attributes

This opens a dialog to set the Label (static text) foreground and background colors and attributes such as bold, italic, underline, blinking text, as well as alignment (left, center, or right).

Value Attributes

This opens a dialog to set the Value (variable data) foreground color and attributes (such as bold, italic, underline, blinking text) and alignment (left, center, or right), as well as the background color.

Register Thresholds

These settings cause the text or some part of the control to change to specific colors at specific values. The values can be hardcoded or can come from values stored in registers giving them user settable values (on an HMI, for example) as well as making the values dynamic. Note that the register mapped to the control as the start register cannot also be mapped as one of the color registers.

Labels

This opens a dialog to define the way the name/title of a register is presented on the web page.

Underline Override

This is used with text and register fields to indicate whether the control is read only (no underline) or read/write (has an underline).

Text Attr (Text Attribute)

This opens a dialog to set the text foreground and background colors as well as attributes such as bold, italic, underline, and blinking.

Read Only

Making a register Read Only disables changing the register value from the HMI.

Security Level

This setting limits access to controls by users with a security access level that is equal to or higher than the control's access level.

Disable/Enable

A control can be disabled (from a user making changes) by mapping this parameter to a register. By default, the control is disabled when the assigned register is true or non-zero. Clicking on the word "Disable" will invert the state of the incoming value making the parameter an "Enable" flag instead.

Invisible/Visible

A control can be made invisible on the web page by mapping this parameter to a register. By default, the control is hidden when the assigned register is true or non-zero. Clicking on the word "Invisible" will invert the state of the incoming value making the parameter a "Visible" flag instead.

Invalid/Valid

When this parameter is mapped to a register and by default the assigned register is true or non-zero, a transparent box with a yellow "X" through it will appear over the control. This can be mapped to a communications fail Boolean to indicate that the displayed data is not necessarily valid (not up to date). Clicking the word "Invalid" will invert the state of the incoming value making the parameter a "Valid" flag instead.

Height

Shows and allows the manual adjustment of the control's height when available.

Width

Shows and allows the manual adjustment of the control's width when available.

X pos

Shows and allows the manual adjustment of the control's X (horizontal) position on the screen.

Y Pos

Shows and allows the manual adjustment of the control's Y (vertical) position on the screen.

Graphic HMI Library Control Descriptions

This section provides information related to each of the graphic controls included in the Graphic HMI library, and how they operate.

Standard Controls

Standard controls are the basic controls to display and enter register values, link to other HMI pages, network/Internet sites and documents, and to display pictures or video feeds.

Register Field (number 123)

Display one or more sequential register(s) on a web page. If not configured as "Read Only", register values can also be changed with this control.

Value List (High/Med/Low)

Display text with various configurable foreground and background colors and attributes based on the value in a register or group of sequential registers.

HTTP Web Page Link Buttons (3 different styles)

These three buttons will open a new browser window to the specified web link.

Graphical HTTP Web Page Link (link with mountains)

This button works the same as the previous HTTP Link Buttons, except that custom graphics can be used for the button.

HMI Page Link Buttons

These buttons serve as a navigation links to one of the other pages in the WUI.

Graphical HMI Page Link (page link with mountains)

This button works the same as the previous HMI Page Link buttons, except that custom graphics can be used for the button.

Video (video camera)

Embed a streaming video camera image or any other network or Internet connected device or site. This can be set to display only a portion of a web page at specific x/y coordinates. A Zoom percentage

parameter may also be configured to show the web page larger or smaller within the window to minimize needed screen size.

Special Modulus Configuration Pages ?<parameters>

Certain special configuration pages of the Modulus system can also be displayed using this control. If Security is enabled, the User must be setup as either “Admin” or “Config” to utilize these special page configurations or the pages and tabs will not be displayed.

To use the special functions, the Http Path must be set to
http://<ipaddress>/web6a.html?<parameter>

These parameters are shown below and are all lower case. It is recommended that the Video control be sized large enough to display the configuration pages. This may take some experimentation. Scroll bars may be enabled if this sizing is not desirable.

alarmschedule: displays the Alarming / Notification | Contacts and Alarm / Notification | Schedule pages.

emailftp: displays the configuration for Communications | Email and Communications | FTP configuration pages.

masterdestinations: displays the Communications | Master Status and Communications | Master Destination configuration pages.

trendconfig: If an SD Card is installed and formatted, this displays the Trending | General and Trending | Traces configuration pages.

Image (still camera)

Place a graphic image (JPEG, GIF, PNG, BMP) on the web page.

Text Field

A static control to place a single line of text on the web page.

Text Memo (text1/text2/text3)

A static control to place multiple lines of text on the web page.

Time and Date (clock/calendar)

Place a time or date display field on the web page. If the control is not set to read-only will allow the setting of the clock or syncing of the clock to the browser’s host system clock. Time is always displayed relative to the browser’s time zone.

Trend Drop In (trend graph)

Place a trend on the WUI page. This gets linked to one of the existing trends (all or a single trend group) that were configured in the trend configuration section.

Get Docs button

This button retrieves documents (such as .txt,.rpt,.htm,.pdf and.csv files) and log files stored in the User Files section of the module.

Event Log Viewer

This control allows you to view any data currently in the Modulus Event Log. This control allows you to view and print the currently displayed data as well as navigate to data in the past. The Event log is a Carriage Return/Line Feed line delimited file that can be viewed in notepad.exe or other editors. It is recommended that when composing Event Log entries in the programming environment (this is the only way that the Event Log data is composed) that you use the LogLine() function for each entry. Since there is only one Event Log in the system, only one Event Log Viewer can be on any given WUI page.

Special Parameters

Table Mode: If the data is delimited by characters such as a comma or semicolon, the Table Mode parameter can be set to that character and each delimited entry will be formatted and displayed in columns.

Poll Rate (Sec): A polling time in seconds (minimum three seconds) can be set to say when the Event Log Viewer updates the data in polling mode. The default is every 30 seconds.

Back Buffer K Bytes: does two functions, first is the initial data get will get this number of K Bytes of data in the past on the initial page load. The second function when hitting the “Back” button is the amount of data asked for in the past each time the “Back” button is clicked.

Button Controls

Back: Go back in the Event Log by the number specified Back Buffer K Bytes each time the button is clicked. This will pause the polling mode displaying “II” in the upper right hand corner in the (Status) field (see below).

Clear: Will clear the current data being displayed. This button does not clear the Event Log itself.

Pause: Will pause the polling cycle to view the data. This button is disabled if already paused.

Go: Will start the polling cycle if paused. This button is disabled if the system is already polling.

Entire: Will load the entire log into the display control for viewing and will pause polling. When the Go button is pressed, the data will be cleared from the control and a new polling cycle will be started.

Snap Shot: Will open a new tab or window with all the data currently in the control and retains the formatting.

Print: Does the same as Snap Shot but removes formatting for printing and brings up the browser’s print dialog to choose a printer.

(Status): Shows a “< >” in the upper right hand corner when polling for event data and when the system is busy formatting data. Shows “II” when paused.

Site Viewer

This control allows you to configure multiple web site pages (sites) within the control to be accessed at runtime via a selection on the top of the control. In the WUI Editor, click on the **Site Editor...** button within the control parameters to edit the list of sites. A least one site is required for the control to work. Click the **Add** at the bottom of the dialog to add more sites.

Title: The text that shows beside the site selector control at the top of the Site Viewer at runtime.

Site Name: The text that shows up in the selector control when selecting a site from the drop down list at runtime.

Site Url Path: This parameter usually begins with http:// and identifies the web address as well as the page and any needed arguments of the of the particular site. Using a “/” only at the beginning of the path will go to the local unit where the WUI is being accessed.

Zoom %: Each site may be configured with a different zoom percentage. A lower number less than 100% shows more information within the Site Viewer (site is smaller than would normally be displayed) and a larger number greater than 100% shows less data on the screen (the site is larger than would normally be displayed). 1 to 200% is allowed.

X Pos: Offsets the X position in the page (across) to display the data of interest within the page display (a video streaming window for example).

Y Pos: Offsets the Y position in the page (down) to display the data of interest within the page display.

Del: This button allows the deletion of a site record from the control.

Up: This button allows the site in question to be moved up the list.

Down: This button allows the site in question to be moved down in the list.

At runtime, the first site entry is shown until the site selector at the top of the control clicks on another site. Only one Site Viewer may be used on a given WUI page.

Config Page Viewer

This html site based control allows for predefined paths to be entered viewing configuration and user interface sites accessible by the browser. It should be noted when security is enabled on the site configured, that at a minimum the user logged into the WUI should have configuration level permissions to view configuration pages. Most site configurations are Modulus I/O centric but can be used for other units such as ScadaFlex II. These are detailed below. If paths other than what are available in the **Config Select:** dropdown are needed then use the Video control or the Site Viewer control to allow a wider range of sites to be entered. When configured the full site path will show up as text in the control when editing. Under runtime the site specified will be displayed as frame within the WUI page.

Special Parameters

Site or IP: Enter the IP address, Site Address name or “/” to access the “local” unit hosting the WUI page. If no site is specified then “/” is assumed to access the local unit.

Scrollbars: Allows scrollbars to be used if the site’s window is larger than the space provided. If turned off it is suggested that the control be sized large enough to see the entire page. Zooming (below) may be used to show more of the page in the space provided but in a smaller format.

Config Select: Allows the selection of specific configuration parameters for each of the following site configurations:

- **All Config Pages:** Shows the site’s full configuration pages and tabs. ScadaFlex II sites may use this parameter.
- **Alarm Schedule and Contacts:** Shows the sites Alarm | Contacts and Alarm | Schedule configuration tabs.
- **Master Destinations:** Shows the site’s Communication | Master Status and Communication | Master Destinations configuration tabs.
- **Email and Ftp:** Shows the unit’s Communications | Email and Communications | Ftp configuration tabs.

- **Trend Config:** Shows the unit's Trending | General and Trending | Traces configuration tabs.
- **Mobile Interface:** Shows the unit's Mobile HMI web page. ScadaFlex II sites may use this parameter.

Cloud Server: Disable the site's ability to seek the Internet Cloud Server for files for the web page and host the files directly from the local unit (not recommended for slower interfaces such as cellular and DSL routers).

Zoom %: The site may be configured with a different zoom percentage. A lower number less than 100% shows more information within the Site Viewer (site is smaller than would normally be displayed) and a larger number greater than 100% shows less data on the screen (the site is larger than would normally be displayed).

X Pos: Offsets the X position in the page (across) to display the data of interest within the page display.

Y Pos: Offsets the Y position in the page (down) to display the data of interest within the page display.

Alarm Controls

Alarm Controls provide visual and audible indications of alarms. An alarm grid provides a full alarm status summary including all active and acknowledged alarms with time stamps. Individual alarm indicators can be used as pinpoint indicators over graphic maps and pictures. A couple of audible alarm indicators can play prerecorded sounds or custom user WAV files stored in the module.

Alarm Grid

This control displays the state of alarms, Acknowledged, not acknowledged, and optionally idle alarms are displayed with activation and acknowledgement time stamps. It includes the option of a built-in alarm acknowledgement button.

The following parameters are unique to the alarm grid.

Alarm Attributes

Text attributes for a displayed alarm while they are in alarm (unacknowledged).

Ack'd Attributes

Text attributes for active alarms that have been acknowledged.

Idle Attributes

Text attributes for a displayed items not in alarm (optional).

Background (Color), Grid Color, Header Font Color

Background color, grid color and header font color for the Alarm Grid.

Show Idle Alarms

Show state of all possible alarms, even those that are not currently in alarm (idle).

Show Alarm Grid

Select when the alarm grid is displayed; always, or only when there are active (unacknowledged) alarms, or any alarms (acknowledged or unacknowledged).

Ack All Button

Enable or disable the Ack All button.

Grid Width

Set the thickness in pixels of the grid lines.

Grid Pad

Set the amount of space (in pixels) between the grid lines and alarm text.

Poll Time

Set how often the module is checked for new alarms (in seconds). Default = 30.

Alarm Control Icons

Alarm Readout Panels (flat/beveled red squares)

These panels (one flat, the other beveled) provide variable background colors based on a register value. The thresholds may be constants or values in other registers. By default, the threshold values are (if no thresholds are configured):

0 = Grey.

1 = Green.

2 or more = Red and flashing.

Configurable Warning Indicator (yellow triangle with text)

A three-state warning triangle controlled by a register value, with custom text:

0 = Control is not visible

1 = Control flashes and displays custom alarm text.

2 or more = Control visible but not flashing, and displays custom acknowledgment text.

Warning Graphic Indicators (yellow triangles with "!" and blank)

A three-state warning triangle controlled by a register value:

0 = Control is not visible

1 = Control flashes

2 or more = Control is visible but not flashing

Audio Alerts (alarm bells)

A control that plays digital audio along with a visual alert indication when activated. There are multiple alarm type sounds built-in, or these controls can be configured to play custom WAV files stored in the "drive(s)" of the module. The control can play the sound once or repeatedly as long as it is activated. The sound can be silenced by clicking on the control (with the appropriate security level) without acknowledging the alarm.

Bargraphs and Panels

Bargraphs and Panels are low-level elements used to customize user supplied graphics and objects and provide finishing touches to items on an HMI web page. They make it possible to add level displays to pictures, variable color and opacity backgrounds for fixed graphics, and highlighting frames around any control.

Bargraph Vertical (plain turquoise bar)

This control is typically used as a level indicator. The mapped register will control the height of the bar according to value in the mapped register and the scale min/max values. This control has a color list configuration using the Static Thresholds and Register Thresholds type parameters. By default, the color list is set to a cyan foreground (level color) on a black background.

Color Panel with Transparency (pastel yellow dot and square)

There are round and rectangle versions of this control. They don't get mapped to a register and are intended as panels to go in front of or behind other controls. The opacity is settable, so they can be translucent. Setting the opacity to 100% will make them opaque. The color can be set and they can have a frame. They will show up as yellow in the WUI designer, but in the set color when displayed on the web page.

Panel with Color List (green dot and square)

There are round and rectangle versions of this control. They have a color list configuration using the Static Thresholds and Register Thresholds type parameters. See the Common Parameters section for more information about Static and Register Threshold parameters.

By default the color list is set to these values:

0 = Grey.

1 = Green.

2 = Red and flashing.

They will show up as green in the WUI designer, but in the set color when displayed on the web page.

Panel Frame (white square white black outline)

This control places a frame around text or other control. It can be used to organize things such as data for a specific process for example, or as a border around data or controls to give the page a nicer appearance.

Buttons and Switches

The Graphic HMI Library includes a variety of switches and indicators. Most of the switches and indicators have a "Read Only" setting, that if unchecked, provide both a switch and an indication capability.

Legacy Pushbutton Switches

The pushbutton switches at the top of the library window provide Set ON, Set OFF and Toggle (push-on and push-off) functionality. For the most part, their functionality has been replaced by the fully

configurable versions of these switches described later in this section, but are included in the library for compatibility. To determine their functionality, hover your mouse over the control in the library to display a “tool tip” description of the control. They either set a register ON (to 1), OFF (to 0), or TOGGLE on each click (activation).

The above controls are an older style and generally not recommended for new designs. The fully configurable controls described later in this section should be used instead.

Padlock Buttons

This control has a toggle action and will latch in the open or closed position. When not configured as “Read Only”, this is a clickable control that can be used to alternately set a register to a 0 or a 1. This control has a settable background color, including transparent.

Selector Switches

Selector switches come in 2 and 3 position types with two different handle styles. They can be used as both a switch (input device) and as an indicator (output device). When not set to “Read Only” they are a clickable control; activated by clicking on the oval “targets” above the switch. The targets are gray if the switch is disabled. The register value for each position and the active color is settable.

Indicator Buttons

These indicators are available in three colors; Green, Red, and Yellow. The color is bright when ON, and dark when OFF. This button has a toggle action. When not configured as “Read Only”, these are clickable controls that can be used to alternately set a register to a 0 or a 1, otherwise they simply indicate the state of the register to which they are mapped. A fully configurable version of these indicators, described later in this section, is available with customizable ON and OFF colors.

Push Buttons

These have a 3D look and come in three colors; Green, Red, and Yellow. They have a toggle action and latch in the up or down position. When not configured as “Read Only”, these are clickable controls that can be used to alternately set a register to a 0 or a 1, otherwise they simply indicate the state of the mapped register.

Illuminated Rocker Switches

There are two styles of illuminated rocker switches; narrow and wide, available in 5 colors. They have a toggle action and latch in the ON or the OFF position. They can be used as both a switch (input device) and as an indicator (output device). The OFF condition is always gray. These are clickable controls that change the value of a register to a 0 or a 1. The off condition is always gray.

Checkbox Buttons

These controls have a toggle action and latch in the checked or not checked position. When not configured as “Read Only”, these are clickable controls that can be used to alternately set a register to a 0 or a 1, otherwise they simply indicate the state of the register to which it is mapped. This control has a settable background color, including transparent.

Configurable Indicator Button

The on and off colors for this control can be configured. The color is bright when ON, and dark when OFF. This button has a toggle action. When not configured as “Read Only”, this is a clickable control that can be used to alternately set a register to a 0 or a 1, otherwise it simply indicates the state of the register to which it is mapped. The default colors are:

ON = light green.

OFF= dark green.

Configurable Buttons (2 styles with text)

These can be configured as an ON, OFF, or Toggle type along with the text and colors for ON and OFF conditions. Two versions are provided, one with an older Windows style and one with a more modern web page look.

Chasers

Chasers are primarily used to show liquid flow by overlaying them on pipes (they appear to be a cutout in the pipe). They have a moving black or white stripe (bubble). The stripe will chase from one end to the other at a speed that is set by the mapped register value and the range min and max settings. The background (liquid) color is also configurable.

Displays

Numeric “digital” displays emulate the look of 7-segment LED indicators. They provide the easiest and least ambiguous readout of a register value. If not set to “Read Only” operation, the numeric display may also be used to change the value in a register.

Seven Segment Display

This is a clickable control that can be used to display and change the value of a mapped register to an Integer or Real number value. This control has the unique capability to internally scale and clamp the displayed value, so conversions such as mA from a sensor to level or flow in engineering units can be done in the display control without having to do the scaling in the module. The number of digits, decimal point position and digit (foreground)/background color are configurable.

Drawing

These are a set of simple drawing objects with lines, corners, arrows, and a circle. When combined together, they are useful to show process flow and to separate or highlight portions of a system diagram on an HMI page. The line thickness and color is set in the configuration parameters of each element. All of the elements have a default line thickness of 10 pixels except the circle which has a thickness of 20 pixels.

Meters

Meters emulate the mechanical operation of their namesake analog devices in order to visually display a register value along with a colored bar/scale that indicate warning or alarm conditions. “Analog” style meters are therefore sometimes a better solution than numeric displays when trying to quickly convey to an operator what readings are at abnormal or hazardous levels.

The meters in the Graphic HMI Library are highly configurable in order to provide the best looking and easiest to interpret displays.

Parameters that are unique to meters are listed below.

Marker Decimal Places

This sets the number of decimal places for when the numeric values are a real number.

Background Color

Sets the background color of the meter.

Marker Color

Sets the color of markers and sub markers.

Marker Font Color

Sets the text color for the numeric values.

Pointer Color

Sets the color of the needle.

Color List

Color List sets the marker line colors which can be a specific color for specific thresholds of static values or data values from registers.

Show Marker Values

This will hide or show the numeric values.

Marker Font Weight

This is for the bold setting of the numeric values.

Background Opacity

This affects the color of the background by making the colored panel more solid or more see-through. The colored panel is on top of another panel that uses grey scale colors but has the gradient effect. A more solid color will show more of the selected color but less of the gradient effect. The gradient effect gives the appearance of a light source behind the meter.

Scale Width

This sets the thickness of the colored scale bar in pixels. It starts at the bottom of the markers (the longer vertical lines in the example), and extends outward away from the numeric values.

Number Markers

This sets the total number of markers (not including sub markers).

Marker Width

This sets the width of the markers and sub markers.

Marker Length

This sets the length of the markers. The sub markers will be $\frac{1}{2}$ the length of the markers.

Num Sub Markers

This sets the number of sub markers between any two markers.

Shine Opacity

The “shine” is an effect that gives the appearance of a glass cover over the meter that is reflecting light. A higher opacity makes the shine more visible. A zero value will hide the shine completely.

Start and End Angles

These parameters change the way the scale looks by changing where it starts and ends. The angle is part of a complete circle, and the 0/360 degree point for this circle is where the 90 degree point is for a normal circle (at the right side half way down).

Adjust Radius

This will adjust the size of the circle talked about above for the Start Angle.

Marker Offset

This sets the distance from the numeric values to the start point of the markers.

Sub Marker Offset

This sets the distance from the bottom of the markers to the start point of the sub markers.

Marker Font Color

This sets the text color for the numeric values.

Marker Font Offset

This sets the distance from the top of the numeric values to the bottom of the scale.

Pipes

Pipes help add realism to an HMI web page for systems with tanks and pumps. Pipe pieces can be set to specific static colors to clarify their function in the system.

Piping systems are put together from individual pieces; straights, corners, Ts, flanges, etc. Pipes can be resized in both directions. To make abutting pipe sections look right, use the Height setting for horizontal section and Width setting in the configuration dialogue to precisely match the pipe “diameters”

Pumps and Fans

The Graphical HMI Library includes ten styles of pumps, two styles of fans along with a compressor and a generator. Some of these controls have variable colors to show running status based on a register value, while some have variable speed rotation animation with the speed of rotation linked to the value in a register.

Configurable Color Pumps, Compressor and Generator

The Configurable Color Pumps, Compressor and Generator have static and register thresholds that control their color and blink attribute. A unique value or range of values can set their color. So for example, they can be a dark gray for OFF, Green for ON, and yellow and/or flashing red for error

conditions. There is no fixed limit to the number of color thresholds. If a color list is not configured, these are the default colors:

0 – Grey

1 – Green

2 or greater – Red and Flashing

Rotating Center Pumps and Cooling Fans

Rotating Center Pumps and Cooling Fans provide an animated display of speed by spinning the center at a variable rate based on a register value and min/max scale settings. They have fixed ON and OFF colors of gray and green, used as shown:

0 – Grey

1 or greater – Green

Scales

Scales are static controls that enhance the readability and functionality of Sliders, Tanks, Bar Graphs, etc. The Scales are extremely versatile and customizable for major and minor mark scaling, size and position, labeling font, as well as background, marker, and font colors, to name a few.

Parameters unique to Scales are:

Range Left/Bottom and Range Right/Top

These parameters set the scale value at the left and right side of the horizontal scales or the bottom and top of the vertical scale.

Decimal Places

This parameter sets the number of decimal places for the numerical value. Integer values with an “imaginary” decimal point are displayed with decimal point to look like a floating point value.

Font Family and Size

These parameters select the font type and size used to label the scale.

Background Color and Opacity

These settings customize the look of the scale background by making the colored panel more solid or more see-through with a gradient effect. Reducing the opacity enhances the built-in gradient effect.

Show Marker Values

This parameter shows or hides the numerical values that label the markers.

Marker Color, Marker Font Color and Marker Font Weight

These parameters set the color of the major marker lines, text font and optional bolding for the numerical values that label the markers.

Justification

Horizontal scales can have their scale values and marker lines on the top or the bottom.

Vertical scales can have their scale values and marker lines on the left or the right.

Number Markers, Marker Length and Marker Width

These parameters set the number of major markers over the length of the scale, and their size.

Num Sub Markers

This parameter sets the number of minor marker lines between major markers.

Marker and Sub Marker Offset

This parameter sets the distance (in pixels) of the major marker and sub marker lines from the edge of the control.

Marker Font Offset

This parameter sets the distance in pixels between the numerical value and the major marker lines.

Slider Controls

The slider controls can serve as both indicators as well as entry devices for register values when not configured as “Read Only”.

They are available in horizontal and vertical orientations, multiple knob styles, and configurable single color and multi-color versions.

The multi-color versions use a color list configuration with a nearly infinite number of color bands to make a control that operators can use to quickly identify good, cautionary and bad levels with just a glance.

Static Images

Static Images are gradient and solid patterns to help build nameplates and labels, and a cross-hatch pattern that can be used to simulate fencing and other types of material at a site. In addition, a brick image with settable color and opacity is included.

As an example, static images may be used as a background “name plates” for a rocker switch to form a better looking control.

Tanks

Tanks are available in animated and non-animated versions. A “site glass” is also included to superimpose a level indicator on the background image of a tank. The animated tanks and site glass have a configurable color list using Static and Register based thresholds, so the color of the “liquid” can change based upon a register value. For example, this can be used to draw attention to low and high level conditions.

Valves

Valves are available as graphic images as well as 2-way, 3-way and 4-way diagram form. Register controls coloring can be used to indicate valve open or closed states.

The valves come in two basic types, the multi position and grey.

For the multi position types, all possible combinations are provided, and each piece for each direction is individually color settable:

The grey types have an ON color and an OFF color which are activated by the value of the mapped register, 0 and >=1 .

Mobile HMI

Modulus modules have a built-in textual mobile HMI that provides for configurable display and entry of values with the extra graphical elements for small screen devices.

The Mobile HMI, also known as the Mobile User Interface (MUI), is a powerful feature that can provide overall system access including status and levels, set points, alarms, and trigger events using the mobile devices web browser.

A "live" depiction of the Mobile interface is pictured on the left hand side of the screen as HMI selections are made.

Access Links

These check boxes , when checked, enable or disable buttons to be displayed at the bottom of the Mobile HMI display area that when clicked on, allow the user to "jump" to the module configuration web pages or the graphical HMI web pages.

Mobile HMI Page Configuration Area

The Mobile HMI can have up to five "pages"; each page with up to 10 displayed variables. The variables can be any combination of numeric or Boolean register data. Boolean data can have customized ON and OFF verbiage to indicate the Boolean state.

Page Name

A user settable name for each Mobile HMI "page" that will be used the label a "button" to jump to that page. Each name may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is Pagex where x is the page number.

Enable Checkboxes

Check the box for each page that is to be enabled. The first page is always enabled (no check box).

Entry

This column is a selection list of all available registers and variables that can be displayed on the Mobile HMI. Clicking on an Entry will bring up a dialog that will allow for selecting a searching for specific variables in the system. The Show All checkbox will change the selection and search list to all register regardless of "visibility" configuration. Show Slot Regs checkbox will include all the registers for communication over the I/O exchange backplane. A description of All Modulus Registers is available [here](#).

Verbiage Off/On

If a Boolean variable has been selected, two selection lists appear to choose the text to be displayed when the variable is either off and on. The Boolean text and colors and be customized under a tab a couple of positions over.

Local HMI

All Modulus modules have a local (front panel) HMI display and pushbutton to show the live values of process variables and setpoints, and optionally change them. Up to 32 different Boolean and numeric variables can be displayed (one at a time).

Entry

This column is a selection list of all available registers and variables that can be displayed on the Local HMI. Clicking on an Entry will bring up a dialog that will allow for selecting a searching for specific variables in the system. The Show All checkbox will change the selection and search list to all register regardless of “visibility” configuration. Show Slot Regs checkbox will include all the registers for communication over the I/O exchange backplane. A description of All Modulus Registers is available [here](#).

Verbiage Off/On

If a Boolean variable has been selected, two selection lists appear to choose the text to be displayed when the variable is either off and on. The Boolean text and colors and be customized under a tab a couple of positions over.

Write and Scan Enables

Check the Write Enable box to allow user to change a value from the front panel of the module. Check the Scan Enable button to automatically scroll through the display of the variables checked.

Boolean Verbiage

Both the Mobile HMI and the Local HMI display have customizable ON and OFF text and background colors for Boolean variables. That customization is done under this tab.

Color

A selection list of all available background colors for the customized text state.

Verbiage

This is text of up to eight characters to be displayed when the state is shown.

Triggers

All HMI displays can use up to sixteen different triggers to initiate actions in a control program. When a trigger is enabled, its name appears in a list in the programming section. The program can then be configured to take an action when the trigger is true or "1". Triggers are on until read by the program, and then the trigger is reset to false.

Trigger Name

A user settable name for each trigger as it will appear on a button in the Mobile or Local HMI, and as it will appear in selection lists in programming and the graphic HMI. Each name may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character. The default tag name is Trigx where x is the trigger number.

Visible

Check these boxes for each trigger name that is to be used in the system.

Programming

Modulus modules support logic programming in three different languages:

- Ladder Logic
- Function Block
- Text

All three languages can be used together in one program.

Programs interact with the rest of the module sections through the numeric ("N") and Boolean ("B") registers and status bits controlled by other sections of the module (such as comm' fail bits).

Subroutines written in one language can be called by any of the others.

The tools for building and debugging graphical and textual programs are included under the Programming tab. The tools will work with every major web browser. A mouse based computer such as a desktop or laptop PC is required to use the tools. Tablets and phones will not display the Programming Tab.

Programs in a Modulus module execute very much like any other PLC. The program executes from start to finish and then loops back and repeats, typically hundreds of times per second. In the case of a graphical logic program, the logic executes from left to right, top to bottom. The text portion of the program executes first, and then the graphical logic. All I/O, registers and variables are "global" so that they are shared throughout the program, regardless of the language.

The program execution path can be altered with GOTO and GOSUB instructions. GOTO instructions are allowed to jump forward or backwards, so be careful not to program an endless loop by using a GOTO statement to jump back to any earlier portion of the program without some form of exit logic. Other than to no longer execute all of the rest of the logic outside of the loop, an endless loop in a users program will have no effect on the operation of the rest of the module (it is an isolated task).

A web based program editor with text and graphical modes is built into the module. The editor is also a compiler that does syntax error checking and conversion of the text and graphical programming to compact lower level programming that is executed by the module CPU. Once a program is developed, source and compiled forms of the program are downloaded to and stored on the unit in flash. Once a program is downloaded and running, the editor becomes a real-time debugging tool with live display of "power flow" for graphical logic, as well as live display of registers and local variables. Values can be

injected into registers and local variables, Booleans can be set and cleared, and I/O points can be forced. There are also single-step and breakpoint functions to make troubleshooting easier. All of the web based the tools to create, modify, and download ladder logic, function block and text programs are found under this **PROGRAMMING** tab.

Ladder Logic and Function Block Editor

The Ladder Logic and Function Block editor is the window displayed when you click on the programming tab. It consists of a single window with programming tools, a program editing area, a tag selector, a status display, and a library.

Primary Tools

The Primary Tools are the ones most commonly used for creating logic programs, including editing, downloading and debugging. Selector buttons across the top of the editor window are used to access them.

Back Arrows (return to the module configuration pages)

Use this button to get out of the Programming page.

Home

Click on this button to return to the home (upper left-hand) position in the current page of the program. This is a *shortcut to scrolling to the top of the document if you are editing an especially large program.*

Download (Lightning Bolt)

Download the entire program (ladder logic, function block and text) to the Controller. This button is enabled whenever a change in the program has been made.

Verify (Check Mark)

Compile the entire program (ladder logic, function block and text) to check syntax and program validity. This button is enabled whenever a change in the program has been made.

Run a Stopped Program (Running Man)

If you stop a program, or if you do not have the Auto Run checkbox checked, you can restart the program running by clicking on this button. Clicking on this button is just like a controller power on or reset in that it clears all of the local variables. Registers in the system will keep their value however.

Continue Running a Stopped Program (Double Right Arrows)

If you stop a program, or if you do not have the Auto Run checkbox checked, you can restart the program running by clicking on this button. Clicking on this button just restarts the program running from wherever it stopped without affecting any of the local variables.

Stop (Stop Sign)

Click on this button to stop a running program. Typical use for this is for enabling single stepping for debugging. Be careful when using this in the field with a live system!

Single Step Through a Program (Stair Step)

Clicking on this button will cause the program to execute one program line or function block at a time (once per click). It is enabled when you stop a downloaded program. The last function block executed is highlighted with a blue box. The last text executed is encircled in a gray box. The status display will show the current line.

Switch Editors (Logic and Text pages with circling arrows)

Clicking on these buttons switches between the ladder logic/function block editor and the text program editor.

Debug (Magnifying Glass)

Click on this button to bring up a debugging panel to display and edit local variables. This panel also has a cross reference feature to locate variables in your program. The cross reference can be printed. Please see the Program Debugging section in this chapter for more information.

Undo (left swirling arrow)

Click on this button to undo recent changes to your program. You can go back up to 25 changes.

Redo (right swirling arrow)

Redo recent undo changes to your program.

Delete Selected Logic Element(s) (trash can)

Clicking on this button deletes any currently selected function block(s).

Duplicate and Paste Selected Logic Element(s) (paste brush)

Click on this button to duplicate any selected logic element(s) (select the logic to be duplicated first). When this button is clicked on, a small gray square will appear that tracks with your cursor. Position the square where you want the duplicate logic to be placed and click once on your mouse.

Secondary Tools

The Secondary Tools are the ones less commonly used for working on programs. The Secondary Tools menu is displayed by hovering your cursor over the small black box in the upper left-hand corner of the editor screen.

File Load and Save

Click on these buttons to store and retrieve a copy of a program (logic and text) locally on your computer.

Clear Breakpoints

This button is always grayed out when working in the logic editor. Breakpoints are only supported with textual programs and the textual program editor.

New Program

Clicking on this button erases the entire program (logic and text). A warning prompt is displayed before actually clearing out the program. This button is only enabled after the program is safely stopped and is disabled when a program is running.

Console

Clicking on this button brings up a floating diagnostic window with a debug console. The console has two sections; one for displaying messages printed to it from the program (using a PRINT command), and the other with an activity log showing status and error information from each editing, downloading and running session. The information in each section can be cleared using the buttons at the bottom.

Find/Replace

This button is always grayed out when working in the logic editor. It is only used by the textual program editor.

Functions

This button is always grayed out when working in the logic editor. It is only used by the textual program editor. It provides a short help note for each of the functions available in text programming and can insert a prototype of the function for the programming to fill out.

Info (Program Information)

Clicking on this button provides a window with information that is primarily helpful for ICL Technical Support. It also shows the build version and usage statistics that are typically on the status bar after a successful compilation.

Print Source

Clicking on this button generates a printout of the entire program (logic and text)

Help

Clicking on this button brings up a condensed programming manual with a description and examples of each of the available programming functions and function blocks.

Program Status Area

The Program Status Area shows the current running status of the program and statistics on program scan time and resource usage.

Auto Run Program

This checkbox controls whether a program automatically runs and loops in a PLC-like scan. It should be checked for normal operation (by default, it is checked). If unchecked, a program will run one scan when downloaded, and then stop.

Current Status

Displays the current program “line number” that is executing, and the last total program scan time. The line number is mostly useful for textual programs (for example, when single stepping), but you should see it changing while even just a ladder logic or function block program is running.

Notifications

Displays the current program memory usage (total for all languages):

- PGM is the percentage of program execution space used
- VAR is the percentage of program (local) numeric variable space used
- ARR is the percentage of array variable and string array variable space used
- BOOL is the percentage of program (local) internal boolean variable space used

- SRC is the percentage of program source code storage used

Text Program Spy List

Double clicking on any variable except arrays will load that variable into the Spy List on the right hand side of the text editor. This spy list is retained through subsequent compile and downloads. When in edit mode, the Spy List will disappear.

Program Editing Area

Depending on the mode, this area contains a graphical (ladder logic/function block) or textual editor. Tabs along the top of both the textual and graphical logic areas enable you to break up your programs into logical "pages". Click on "Add Page(s)..." button to add another tab/page and you will be prompted for a name (default is Page 2, Page 3 etc...) .

Right click on a tab to rename, move the page's position and execution order relative to the other tabs, delete it and all of the programming code under that tab, and secure the code under that tab with a password.

Page names have no effect on program execution.

Text Logic and Graphic Logic Page Security

Each page that is secured has its own password. The password can match that of other pages but must be entered when each secured page is viewed for the first time.

When a text or logic page is secured and logged into with the password, you are allowed to change the password and/or remove security if desired or log out of the page.

The login is stored for future sessions in the browser but moving to another computer or browser will facilitate having to login again.

When security of a page is added, saving of source code for that page is encrypted to protect it from being copied or modified. The program will still compile, download, run and Watch List variables may be viewed. Without the page password invoked, the code may not be viewed if printed from the Print Source... menu option. It can however be exported for backup in its encrypted form using the File Save... menu option.

Tag Selector

The Tag Selector (floating) window at the bottom of the editor window contains pull-down lists of every register and internal system variable. Selecting a tag from these lists inserts a Read Only or Read/Write register (as appropriate) into your logic program. Normally, these lists only display N and B registers that are marked as "visible" along with the System Registers, but all registers can be included by checking the "All" checkbox. A facility is also provided to rename any non System Registers. This saves time by not requiring switching to the module configuration pages. All function blocks that use a renamed variable are automatically updated. The textual program is not automatically updated.

A full description of All Modulus Registers is available [here](#) .

Programming, Functions, and Function Block Library

Below is a link to the Help section of the programming environment with a description and examples of each of the available programming functions and function blocks.

[Programming Help \(Internet\)](#)

[Programming Help \(Local\)](#)

Trending

Modulus I/O modules support a micro SD card for long-term storage of I/O and register data, and on-demand lookup and graphing of selected portions of the data, as well as generated reports and automated transfers of the data to users and remote computers. Trending can record up to 63 points of I/O and register information at either 1 second or 8 second intervals for nearly a century (using a 256GB micro SD card).

The trending tab appears when a formatted micro SD card is detected upon a reset or power on startup. The card must be formatted to be compatible with the trending system. This is in addition to a normal "Windows" format.

To format a micro SD card that has been inserted, use the "Format SD Card" button under the SYSTEM | MISCELLANEOUS tabs. Note that a settable parameter associated with this button is the "File System Size (GB)". When the memory card is formatted for the module, a portion of the card is retained for normal Windows compatible file storage (the amount entered as file system size). The remainder is allocated for trending storage. Generally, 1 GB is sufficient for file system storage in most systems unless a large number of video clips or manuals/documents are to be retained in the module. After formatting a micro SD card, the module should be reset to get the card "mounted".

When a properly formatted card is installed and mounted, the Trending tab will be displayed between the Programming and Special Functions tabs. Under the Trending tab are the following tabs:

Viewer

This tab displays the trend graph. By default, it displays a current strip chart of the most recent data recorded, but it can also be used to display historical information.

Note that a trend graph will only be displayed if at least one trend trace has been selected (under the TRACES tab) and assigned to a trend group.

Group Select

Trending data (pens) can be associated with groups so that when a group is selected, all of the traces or pens associated with that group are displayed together and unrelated data is hidden to avoid confusing clutter. Group Select is a selection list to select an individual group of traces, or set to display all groups together.

Trend Viewer Operation

The trend viewer consists of a graphical display with time stamps along the bottom and scaling label on either of both the left hand and right hand sides. Along the top are quick selections to set the viewer

mode to the most commonly used settings; strip chart (continuous) display, or historical display showing a snapshot going back for the last hour, 4 hours, 8 hours, 12 hours, 1 day, 3 days, 7 days, 30 days, 60 days and 90 days. An additional button selects generating a visual or spreadsheet report of the data being displayed.

Clicking on the graph moves a red cursor to that position. A legend box for each axis is displayed in the lower corners with the exact data recorded for each trace at the cursor position with the precise time stamp.

When not in Strip Chart mode, holding down the left button of the mouse and dragging to highlight a portion of the graphed data will zoom in on the data in the highlighted area. There are also "zoom in" and "zoom out" buttons at the top of the graph. Towards the right is an indicator that shows the current mode (strip chart or historical).

Viewer Controls

There is a small black box in the upper left hand corner of the graphing area. Using your mouse to hover over this box will cause a hidden controls menu to be displayed:

Reports

Custom inquiry reports can be pulled on the historical data by selecting this button. Instead of just allowing you to go back from the current date, you can select a starting date and number of days to be retrieved. You can also select a resolution so that even though the data may be recorded once per second, a reduced size report can be generated with lower resolution of up to 12 hours between points. Data can be retrieved as a formatted list (HTML view) or as a spreadsheet file (CSV Download). You also have a choice of selecting the report timestamps in local time or GMT time. GMT time is usually best for CSV reports since people in different time zones can view the same data and the spreadsheet program will properly display the data corrected for their time zone and daylight savings. HTML view reports are normally best if pulled using the current time zone if they are being viewed locally.

Traces

A trend graph displayed with many traces all at once can be confusing to look at. Under the TRACES button, the display of individual traces can be enabled and disabled by individual users to customize the display for their own personal purposes.

Settings

Under the SETTINGS button, individual users can customize the graphical trend display. There are selection boxes to enable or disable generation of Min/Max and Average statistical data, and to control the display of the legend and cursor.

Below this are controls to manually scale the left and right axis. When both the Minimum and Maximum values are set to zero, the scale is automatically adjusted to the displayed data minimum and maximum values each time the display is refreshed. The user can also customize the rate at which the graph is refreshed (especially useful for data sensitive cellular applications), and customize the Strip Chart display time to show more or less data across the width of the chart. To save settings changes for later, be sure to click on the "Store Options" button at the bottom of the dialogue box.

Date Range

When the viewer is in "Historical" mode, the "Date Range" button is enabled. Under this button, you can select a display range for a graph down to the day and starting/stopping hour. To save settings changes for later, be sure to click on the "Store Options" button at the bottom of the dialogue box.

Info

The "Info" page has information that may be useful if you are working with technical support.

Stats

The "Stats" page has statistical information for the displayed traces including their last recorded levels, as well as their Minimum, Maximum, Deviation, and Average values across the displayed graph. The start and end time stamps of the graph are also shown.

Mode

The Mode button switches the display between Strip Chart and Historical modes each time that you click on it.

Zoom

The Zoom button alternately switches how zooming works. In DRAG mode, the user holds down the left mouse button and drags across the graph to highlight an area to zoom in on. Some devices do not support this graphical dragging operation. In that case, they can use CLICK mode where the user clicks on either end of the area that they want to highlight and zoom in on.

Defaults

Clicking on this button sets the user settable graphical settings to their factory default states.

General

This tab displays the general configuration parameters of the trend graph display. Most of these settings are changeable by the user for their own computer, but the settings here define the starting configuration for each user.

Config

Strip Mode Enable

Check this box if the graph should start in Strip mode, otherwise it will start in Historical mode. In a cellular system, you may want to not have users start in strip mode since it auto-refreshes. An unattended screen will continue to use data on the cellular plan.

Strip Default Display (Min)

This parameter sets the amount of data (time) displayed across the window in strip mode. The default is one hour. The number of displayed points is spread across the total display time. On most screens, this will provide a visual resolution of about 5 seconds.

Strip Interval

Sets the speed at which the strip chart is refreshed. Faster intervals will give a smoother movement but use more data and bandwidth. Slower intervals will give a more "jerky" movement as the strip chart updates. The default interval is 30 seconds.

8 second sampling

Check this box to slow down the sampling rate from 1 second to 8 seconds. The slower sampling rate will extend the recording time on the micro SD memory card by a factor of 8.

Trend Style

This is a selection list to select the visual look (color scheme, etc.) of the graphs.

Right and Left, Maximum and Minimum

These settings set the extents of the right and left hand axis to scales the display of the trend graphs assigned to those axes. If both the maximum and minimum values for an axis are set to 0, the trend display is automatically scaled to the minimum and maximum values of the data tied to each axis.

Format SD Card

To reformat a micro SD card that has been used for trending and file storage, use the "Format SD Card" button. Note that a settable parameter associated with this button is the "File System Size (GB)". When the memory card is formatted, a portion of the card is retained for normal Windows compatible file storage (the amount entered as file system size). The remainder is allocated for trending storage. Generally, 1 GB is sufficient for file system storage in most systems unless a large number of video clips or manuals/documents are to be retained in the module. After formatting a micro SD card, the module should be reset to get the card "mounted".

Reset Trending Data

Clicking on this button clears all historical trending data from the Micro SD card and resets the initial time and date stamp to the current time and date.

Traces

Under this tab, the variables to be trended are selected, assigned to groups and have display attributes assigned to them (color, line style, and scaling axis). The trend groups can also be named here to give them meaning to users.

Trace

Trace Select

Up to 63 numeric and Boolean variables may be trended by selecting the variables in the selection lists in this column. Clicking on an Entry will bring up a dialog that will allow for selecting and searching for specific variables in the system. The Show All checkbox will change the selection and search list to all registers regardless of "visibility" configuration. Show Slot Regs checkbox will include all the registers for communication over the I/O exchange backplane. A description of All Modulus Registers is available [here](#).

Trend Groups

1 through 8

Trend data can be grouped by their logical functionality so that they can be displayed together or included together in reports while excluding other trend data. A single trend pen must be assigned to at least one trend group, and as many as all eight groups using the checkboxes.

Trace Style

Color and Style

Each trend pen can have a unique color and line style (width and solid/dashed pattern) to help distinguish it from other traces in the graph.

Right Axis

Click on these boxes for each trace that is to be scaled to the right axis. If left unchecked, the left axis is used.

Trend Groups

Each trend pen can be assigned to one or more trend groups. Traces that are logically associated together should be assigned to the same group(s). The trend groups have user settable tag names to make them more meaningful to the user. The tag names may be up to 32 characters in length and must begin with a non-numeric (alphabetic) character.

Special Functions

The SPECIAL FUNCTIONS tab provides access to the built-in PID control and pump control functionality in Modulus I/O modules.

PID

There are four Proportional-Integral-Derivative (PID) control loops built into this module. They are configured and activated by entering the following parameters per loop:

Source (PV)

Enter the in signal source (process variable). This will be either an analog input point or an N register.

Setpoint

Select either an analog input or an N register to be the source of the control setpoint.

Hold

As an option, select either a digital input or a B register to enable or disable the PID loop operation. When on, this input freezes the PID loops functionality.

Source Normalization Span

Sets the maximum span of the Source (PV) representing 100% for the loop error calculations.

P, I and D Gains

Increasing the gains of the separate Proportional, Integral and Derivative sections increases their impact on the output of the PID loop. Increasing the Proportional Gain will improve the responsiveness of the loop, but too much Proportional Gain will cause overshoot and oscillations at the loop output. Too low an Integral Gain will make the loop slow to stabilize while too high an Integral Gain will also cause the loop to oscillate. Derivative looks at the rate of change of the process variable. Using it can improve the speed at which a loop responds. Derivative gain should be used judiciously if at all though, since it increases the input of noise in the process variable on the output.

Integral/Derivative Times (S)

This parameter sets the speed at which the Integral and Derivative values are sampled and recalculated.

Reverse Acting

Check this box when the desired operation of the loop is to drive the output lower when the Process Variable increases over the Setpoint.

Output Deadband (%)

Set this parameter to eliminate "hunting" by not adjusting the output for very small changes.

Map Analog Output

If the output of the PID loop is to be an analog signal, then select either an analog output or an N register here.

PWM Output Period (S)

If the output of the PID loop is to be a duty cycle controlled digital output, set the 100% duty cycle period here.

Map Digital Output

If the output of the PID loop is to be a digital signal (such as a heater contactor) then select either a digital output or a B register here.

Pump Control

There is a triplex pump module built into this module. It can control one, two, or three pumps with alternation using a level signal or float switches.

Alternation/Control Scheme

Select the type of control operation from a selection list here. Options are to use a level sensor or float switches with "Flip-Flop" alternation (each new start sequence uses a different sequential pump), alternation based on pumps starts or runtime, or no alternation. The pump module can be used for both "pump up" and "pump down" applications.

Float selections are specific for pump up and pump down.

Setpoint pump up or pump down control is done based on “On” and “Off” Setpoint levels. If the “On Setpoints” are greater than the “Off Setpoints”, then the system is a “Pump Down” configuration. If the “On Setpoints” are less than the “Off Setpoints” then the system is a “Pump Up” configuration.

Lead, Lag and Lag2 Setpoints operate as individual pairs and apply alternation to the pumps according to the alternation scheme which can be setup as:

- “No Alternate”
- “Flip-Flop” always alternate
- “Starts” the lease number of Starts first
- “Runtime” the least amount of Runtime first.

Alternation is constantly evaluated. Disabled pumps for any reason will be last in the sequence. The number of Call Outputs mapped is the number of pumps utilized in the system.

Enable Float AND Level Controller on Local HMI

By default, the Local HMI will have a display section showing either Pump Level or Pump Floats based on the Alternation/Control Scheme selected. Check this box if it is desired to have both systems shown at the same time. This can be useful if a level system is used primarily but programmatically changed to a float system for backup control should the level itself fail.

Pump Fail Timer

A pump failure will be detected when the time from when a pump is called to the time that a pump running status signal is received back exceeds this time period setting if the Run Input is mapped. If the Run Input is not mapped, this parameter has no effect.

On Pump Fail, Leave Call On

Check this box if when a pump failure is detected, the module should leave the pump call output on. Otherwise, the failed output is turned off when an alternative pump is started.

Pump Error Alarm Group En (1-8)

If a Pump Control Error is detected, an alarm notification can be sent out to one or more selected groups.

Primary and Secondary Pause inputs

Digital inputs or B registers may be used to temporarily turn off the pump outputs with these two control inputs. For example, a well pump can be paused if the well level drops too low or an over temperature condition is sensed even though there is a demand for water.

Inter Pump Delay (S)

When not zero, the system will wait this time in seconds after a Pump Call has been changed before changing any other Pump Call. This will prevent multiple pumps actuating or shutting down at the same time.

Pump Alternation Recycle Timer (M)

This parameter is available only when doing Setpoint Alternation control. It monitors the time that any pumps in the system have been running continuously and if this time in minutes elapses will reset the pump controller and re-sequence the pumps. The timer is reset once pumps are re-sequenced when all pumps have shutdown and a new pump is required.

It is highly recommended this functionality be used in conjunction with the Inter Pump Delay (S) parameter so that pumps are removed and recalled as necessary in an orderly fashion so that damage is not caused to the equipment.

Pump_Sequence

Shows the sequence in which pumps are to be called. This register is available in programming and the Web User Interface.

Individual Pump Mappings and Status

Call Outputs

Map the output(s) of the pump module to Digital Outputs or Boolean B registers for each pump. Mapping the first pump output enables the option of a second pump. Mapping that second pump output enables the option of a third pump.

Auto Inputs

If external Hand-Off-Auto switches are used in a pumping system, the Auto inputs should be mapped to either a Digital Input or B register. The module will not attempt to use a pump whose Auto input is off (alternation will skip over this pump).

Run Inputs

Run Inputs are used to detect gross pump failures. If enabled and a pump call is turned on, a pump running confirmation signal is expected a short time later. Otherwise, a Pump Failure error is annunciated. The pump running signal is normally from an auxiliary contact on the pump motor starter. The Pump Fail Timer (S) parameter, if set, determines the amount of time to wait for the run input to actuate before activating the Pump Fail and associated alarm. The run input can be from a Digital Input or B register.

Fault Inputs

If assigned and set to TRUE on a pump that is called, that pump's call will be removed and the next pump in the sequence will be called. If the Fault Input assigned remains TRUE, the pump will not be called in the general sequence until the Fault Input returns to FALSE. If an alarm is desired from this input, it should be configured on the Digital Input or B register assigned. This status will not generate a Pump Failure.

(Software) HOA Selector

A software Hand-Off-Auto (HOA) Selector is provided for each pump to supplement or replace a hardwired selector. The HOA status can be set here, as well as by registers available to the programming and HMI sections. These registers are Pump1_HOA, Pump2_HOA and Pump3_HOA.

- 0 is OFF
- 1 is ON or hand
- 2 is Auto

Starts and Runtime Hours

The module monitors and accumulates the number of starts and runtime hours for each pump. Both values can be edited or cleared by clicking on them. Hovering over the Runtime Hours parameter shows the Runtime in seconds the way it is stored in the internal registers. These registers are retained through a reset or power cycle.

Pump Fail

There is a Pump Fail status indicator for each pump. Pump Fails are cleared when pumps are re-sequenced, the Hand Off Auto configuration register is set to non-auto or when the mapped Auto Input is set to FALSE then TRUE again.

Alarm Disable

Check this box to disable alarm annunciation for this pump.

Pump Scheme Specific Controls

Based on the type of control selected for the alternation scheme (level or float control), a different set of configuration parameters are displayed at the bottom of the pump module page:

Sensor Level Control parameters

Sensor Level control uses an analog signal to control pump operation. The signal can come from a local analog input, or from an N register when the level is read from a remote tank by radio telemetry. With level control, there are up to three pairs of on and off setpoints—Lead, Lag and Lag2. As an option, the signal source and setpoints can be switched to a second set. This could be to optimize for time-of-day energy costs or using an alternative sensor signal and setpoints when remote communications to a tank fails and line pressure at the pumps must be used for control.

Source

This is analog level signal source; either a local analog input or an N register.

Debounce On/Off

Debouncing of the analog signal is provided to filter against "noise" and wave action. With debounce, the signal must remain continuously above or below a setpoint for the specified amount of time in order for the control action to take effect.

Setpoints

The analog level signal is compared to the setpoints determine when the pumps turn on and off. The actual pump sequencing order depends on the alternation scheme selected, so the setpoints refer to the

Lead (1st) pump, Lag (2nd) pump, and Lag2 (3rd) pump. The format of the setpoints follows the format of the source signal. For example, if the analog signal source uses a single decimal place, the setpoints inherit this same format. Which pump actually gets called depends on the Alternation/Control Scheme setting and whether the pump is in Auto or Failed.

A/B Selector

When configured, a single Boolean input or B register may be used to switch pump control operation to a second analog source and set of setpoints.

Float Switch Control parameters

Float switches can be used as a signal source to control pump operation. The switches open and close at the various levels required to control individual pumps. The module can be set to use the switches for either "pump up" or "pump down" operation. Intelligent error detection is provided to sense and announce an alarm when a single float switch fails.

Fail Shutdown Timer (M)

If a float switch "sticks on", a pump could run continually forever. To avoid this, a time period can be set to cause the pump module by the failure of this float to turn off after a fixed period of time and announce an error. Setting the time to 0 disables this functionality.

Two Float failsafe Timer (M)

If a pump turns on based on a first float, but stays on for a long (settable) period of time without a second float switch signal turning on or the initial float switch turning off, the assumption is that the second float switch has failed (open). The module will attempt to start the next pump in the alternation sequence, and announce an error.

Alarm Disable

Check this box to disable alarm annunciation for float switch errors.

Float Control

There is a Float Control status indicator to indicate normal operation or when there is a failure.

Float Status

The Float Switch Status section displays the state of the float switch inputs using green "LED" indicators. The source of the float switch signals can be set to Digital Inputs or B registers in the "Reg" column. For maintenance and diagnosis purposes, the state of the float switch signals can be forced in the "Frc" column when using Digital Inputs. If a B register is used, the "Val" field may be clicked on to turn each register on and off if the B register mapped is not set to read only. The number of floats used is always one more than the number of Pump Calls mapped.

System

The SYSTEM tab provides access to the various utility functions for Modulus I/O modules.

Info

Under this tab are displayed the firmware versions of each software component of the module, the total available storage usages and module hardware information.

Logs

Modulus modules retain three types of logs:

- System Log - all error messages and warning are recorded to this log
- Event Log - a user defined log written to from a user program
- Alarm Log - all alarm information (activations and clearing) are recorded to the log

Under this tab are the tools to display or download any of these logs.

System Log xx% Full

Display Latest

Click on this button to display the entries made to the System Log since the last time that is was viewed or downloaded.

Display Full

Click on this button to display the entire System Log.

Download CSV Latest

Click on this button to download the entries made to the System Log since the last time that is was viewed or downloaded. The downloaded data is in standard spreadsheet CSV format.

Download CSV Full

Click on this button to download the entire System Log. The downloaded data is in standard spreadsheet CSV format.

Display or Download Days back

Click on these buttons to display or download a portion of the System Log going back the number of days set in the entry field.

Clear

Click on this button to reset the System Log, removing all log entries.

System Log Enables

In this section are a set of checkboxes to filter the data retrieved when the system log is displayed or downloaded. By default, all data is enabled, but individual boxes can be unchecked to eliminate various types of data in the log. The check boxes are strictly filters for log data retrieval and have no effect on the storage of the log data.

Event Log xx% Full

Display Latest

Click on this button to display the entries made to the Event Log since the last time that is was viewed or downloaded.

Display Full

Click on this button to display the entire Event Log.

Download Latest

Click on this button to download the entries made to the Event Log since the last time that is was viewed or downloaded.

Download Full

Click on this button to download the entire Event Log.

Clear

Click on this button to reset the Event Log, removing all log entries.

Alarm Log xx% Full

Display Latest

Click on this button to display the entries made to the Alarm Log since the last time that is was viewed or downloaded.

Display Full

Click on this button to display the entire Alarm Log.

Download CSV Latest

Click on this button to download the entries made to the Alarm Log since the last time that is was viewed or downloaded. The downloaded data is in standard spreadsheet CSV format.

Download CSV Full

Click on this button to download the entire Alarm Log. The downloaded data is in standard spreadsheet CSV format.

Clear

Click on this button to reset the Alarm Log, removing all log entries.

Files

Under this tab are the tools for maintaining the files on the internal "B" flash disk drive, and if inserted, the "C" micro SD card drive.

B Drive (internal)

The files listed below are stored on the internal flash disk in the module. Double-clicking on a filename will open the file.

Add File: <browse>

Click on the browse button to select a file to be transferred from your computer to the internal flash disk in the module. You can also simply drag and drop the file on to the browse button.

Filename, Date and Size

The names, creation dates and times, and sizes of the individual files stored on the internal flash disk. The file names are Windows compatible and can be up to 260 characters long. The filenames cannot include:

- slash (/) or (\)
- question mark (?)
- vertical bar (|)
- right angle bracket (>)
- left angle bracket (<)
- colon (:)
- asterisk (*)
- quotation mark (")

Del

Clicking on these buttons deletes individual files

Edit Report

The module recognizes .htm and .rpt files as report files. Clicking on these buttons opens the report files in the module's report editor.

Free/Wasted/Reset

When a file is "deleted", it is internally just marked for removal. Since erasing flash memory could affect real time operation, the deleted files are marked and their disk space simply listed as "wasted" along with the Free (available file space). Clicking on the Reset button will clear out the wasted space, returning it back to the available free space. Note that this operation resets the module, so some real time operations may be momentarily affected.

C Drive (SD card)

The files listed below are stored on the micro SD card if it is inserted, formatted and mounted. Clicking on a filename will open the file.

Add File: <browse>

Click on the browse button to select a file to be transferred from your computer to the micro SD card flash disk in the module. You can also simply drag and drop the file on to the browse button.

Filename, Date and Size

The names, creation dates and times, and sizes of the individual files stored on the internal flash disk. The file names are Windows compatible and can be up to 260 characters long. The filenames cannot include:

- slash (/) or (\)
- question mark (?)

- vertical bar (|)
- right angle bracket (>)
- left angle bracket (<)
- colon (:)
- asterisk (*)
- quotation mark (")

Del

Clicking on these buttons deletes individual files

C Drive File Purge

Micro SD cards can end up storing a large numbers of files. A facility is provided to delete files of certain types and ages to remove them in bulk. When configured, the Purge will take place each day at 1:00 am.

Purge Extensions

Enter the filename extensions of files to be deleted, separated by commas. The word "ALL" can be used to delete everything from the C drive that is older than the setting below.

Days older than

Only files older than this setting in days will be deleted. This values range is 1 to 3652.

Purge Now

Click on this button to remove all files that fit the selection criteria above.

Security

Under this tab are collected together the elements of the module that control access to its data by users and protocol communications.

Admin Account (MUST be filled out to enable Security)

Username/Password

These are the username and password for the System Administrator. Both the username and password can be up to 16 characters long. Protect these credentials since they allow full access to the module, its configuration and data, as well as the ability to alter the security levels and settings themselves and set up any other type of user account.

Enable Security

Once at least an administrator username and password have been entered, click on this box to enable security in the module. Once enabled, the system will reload the page and ask for the new credentials.

Accounts

Usernames and Passwords

These are the usernames and initial passwords for all of the rest of the users that can access the system when security is enabled. Both the usernames and passwords can be up to 16 characters long. Password entries are initial passwords. Users can alter their own passwords at any time. A user's password is

never viewable to anyone including the system administrator. If a user forgets their password, the system administrator can just assign them a new initial password.

Permission Level

When using security, for each user account, one of 32 security access levels can be set.

There are three types of "normal" user accounts with 10 levels of access with each type. None of these accounts can make configuration changes in the module. The lowest level (User-x) can generally view data but not make any entries or changes to registers or accumulated statistical data in the system.

Users with the next class of permission level (User R/W - x) do have the ability to make entries to registers enabled for write access but not clear or alter accumulated data.

Users with the next class of permission level (User Full - x) have the ability to make any value changes except for module configuration.

The graphical Web User Interface can be configured so that access to a web page, or write access to any individual control on a web page can be limited to a minimum security level. The write security level is one of the configuration parameters for each control. Note that all users with system access see any data on a web page if they have the access authority to get into that page.

The next higher class of security access is "Config Read/Write" which allows access to the module configuration settings themselves in addition to all of the access allowed by the lower security levels. The only thing that users with security level cannot do is set up accounts for other users.

The top security level is Administrator, which has all of the permissions of the lower levels, plus the ability to set up and change user accounts.

General

Only allow Configuration from Local Network

Checking this box limits the ability to make module configuration changes using a device connected on the local subnet. Devices that are connected through one or more routers to get into the module are blocked from making configuration changes.

Disable "Full Website" Button on the Mobile HMI

On the mobile HMI pages, the "Full Website" button allows users to get to the rest of the module web pages if they have a sufficient security level. If this box is checked, the "Full Website" button will not be displayed.

Allow Graphical HMI Access w/o logging in

By checking this box, the developer may choose to let users access the graphical Web User Interface HMI pages without needing to log in (when security is enabled). Be careful using this as all user access will be anonymous and there will be no user access level control. All controls will be read-only.

Allow Unsecured Log Gets

By checking this box, allows an external device to extract log data without logging into the module (bypasses requiring HTTP login credentials).

Failed Login Limit

By setting this to a non-zero value, you can limit the number of successive unsuccessful user login attempts. When a user exceeds this limit, they will be locked out from any more attempts for a configurable time period set below.

Failed Login Lockout Time (M)

If the number of times that a users unsuccessfully attempts to log in exceeds the value set above (Failed Login Limit), the user will be prevented from any further attempts for the time period entered here (in minutes).

AES Encryption Key

AES-128 encryption is used to secure protocol communications using the SDX protocol. A 16 character (128 bit) string is used as the key to encrypt/decrypt the messages. The key string can be (and should be) changed here for your specific system. All devices that communicate together must have the same encryption key.

Ping Disable

By checking this box, the module will not respond to a ping message.

Disable Config Register Write Protect

By checking this box, the unit will allow access to protected configuration registers in Modbus, IOX and Satellite protocols. This can also be done by writing 12345 to the Protection Register at Holding address 605. The protection register is reset when the unit is reset; the checkbox is saved between resets.

Ethernet (slave protocol enables)

In this section are checkboxes for each of the slave protocols supports through the Ethernet port. Each box enables a specific protocol. For security purposes, unused protocols should be disabled by un-checking their respective boxes.

Bus (slave protocol enables)

The bus port can be configured to operate as a conventional RS-485 serial port when not used for inter-module communications. In this section are checkboxes for each of the slave protocols supported through this port when used in this mode. Each box enables a specific protocol. For security purposes, unused protocols should be disabled by un-checking their respective boxes.

IOX Disables

IOX is the proprietary protocol used for high-speed peer-to-peer communications between Modulus modules. Part of the IOX functionality is the ability to pass web page and protocol messages between modules. For example, this allows the web pages and registers of all modules on the bus to be accessed from a single module's Ethernet port or cellular modem. In some situations, this could be a potential

security risk. Checking the boxes in this section disables redirection of web pages, and SDX or Modbus protocol traffic.

Comx (slave protocol enables)

Slave protocol access and support by the serial communication port(s) of a Modulus module can be controlled by checkboxes in these sections (one section/set of checkboxes for each port). There are checkboxes for each of the slave protocols supported with each box enabling a specific protocol. For security purposes, unused protocols should be disabled by un-checking their respective boxes.

Time

Current

System and Local Times

In this section, the internal time and date of the module is displayed. The system time is "Greenwich Mean Time" (GMT). The local time is the Greenwich Mean Time adjusted for the local time zone where the controller is located. The modulus modules use Greenwich Mean Time for the time stamps in all logs, but the log data can be extracted as either GMT or local time.

Zone

Time Zone

This is a selection list to set the time zone in which the module is physically located.

Daylight Savings Time (manual)

Check this box to have the controller adjust its local time ahead by one hour for daylight savings time. This is also exposed as a system variable so that a program of HMI can be used to manually select daylight savings time.

Suppress RTC Sync At Startup

When checked, the web browser will NOT ask to sync the systems clock to the local computer. The setting is stored in the local web browsers storage not in the module.

Daylight Savings Time (Auto)

The module can automatically adjust its local time for daylight savings by configuring the starting and end month and days for the time adjustment.

NTP Server Address and NTP Test button

If the module has access to the Internet, it can get a time update from a Network Time Server using the standard NTP protocol. The IP address of the NTP Server should be entered here. The access to the NTP server can be tested by clicking on the Test NTP button.

Bus

Time Sync Master

Checking this box enables this module to operate as a time server to the rest of the modules on the bus. This is most appropriate if the module has an Internet connection to get its own time updates, or if it is a communications module with a battery backed clock and calendar. Note that there can be multiple Time Sync Masters on the bus.

Satellite

Synchronize Time From Satellite

Checking this box enables a connected Satellite modem to update the system clock. The update is done once every 8 hours when enabled.

Monitor

For system diagnosis, all Modulus modules have built-in communications monitoring tools for bus communications, as well as e-mail and FTP (file transfer) operations. In addition, modules with other serial ports, radios or cellular modems have monitors for their communications too. The monitor displays and keeps a historical record of all information transmitted and received along with any system error and status information that might be related. The data is saved to a 1 MB circular file on the internal flash disk.

This section describes the general operation of the monitors that are available in all modules.

Information regarding the monitor functionality specific to modules with internal radios and modems is available through ICL Technical Support.

In the monitor window, all recorded information is displayed in a window on the left side of the screen. System messages (not directly related to the actual data being monitored) are shown with white text and error messages are shown with red text. Outgoing message traffic uses yellow text while incoming messages are displayed as green text.

Monitor Select

This is a selection list of the available monitors in the module. This will include monitors for the Bus, E-mail, FTP, MQTT and any serial ports, internal radios or modems in the module. When a monitor is selected, the monitor page "morphs" to include only the buttons and controls that apply to that specific monitor.

Monitor Mode

This is a selection list that determines how the monitor data is interpreted; as ASCII or hexadecimal binary data. In Auto mode, the module uses the mode most frequently needed for a particular monitor.

Clear Monitor

Click on this button to clear out the information in the monitor window.

Pause

Click on this button to momentarily stop the recording of data in the monitoring window.

Snap Shot

Click on this button to open a new tab in your browser with a "frozen" copy of the data in the monitor window.

Snap Shot (Printer Friendly)

Click on this button to clear open a new tab in your browser with a "frozen" copy of the data in the monitor window. The data is displayed in a plain black and white text format that is easy to print.

Rcv'd and Total

Statistical counts of the amount of received and total data shown in the monitor window.

Back and Distance

Scroll bars are used to view what has just happened, but by entering a memory size and clicking on the "Back" button, you can jump back further into the recorded data and scroll through the historical record of communication transactions.

Send Raw

Click on this button to inject a message, entered in the field on the right, into the outgoing data stream.

Miscellaneous

Under the Miscellaneous tab are a group of maintenance utilities to:

- Update firmware in the module
- Make configuration backups
- Import and export registers
- Reset configurations and calibration values to factory defaults
- Reset the module and other modules on the bus
- Operate a built-in I/O simulator
- Format a micro SD card in the module and record backups to it

Utilities

Download Firmware/Configuration

Use the "Browse" button to select a file in your computer to download into the module. You can also drag and drop the file onto the Browse button. The same button is used to download both firmware and library updates as well as configuration backups. The progress of the update is shown both on the screen and on the front panel display of the module.

Retain Previous IP Address

Check this box before starting to restore a backup file if you do not want to restore the IP Address from the file. The Gateway and Mask will also not be restored. This is not a retained configuration object and will be disabled after a power cycle.

Global Firmware and library Install Buttons

Once a firmware or library file update has been downloaded into the module, the update can be simultaneously propagated and installed over the bus into any similar type modules. This eliminates the need to download updates to each individual Modulus module on the IOX Bus.

Backup and Restore Configurations to internal file

Click on these buttons to make a backup or restore a backup to the internal "C" micro SD card in the module (if available).

Import or Export Register Data to file

Click on these buttons to make a file containing the registers and associated data used in the module. The file is named `reginit.csv`. It can be edited externally on your computer. If the file exists, the module will automatically load its contents on startup, including initial values if present.

The register information is stored in a file called **`reinit.csv`**

The contents of a typical `reginit.csv` file are depicted below:

```
:REG:,Value,TagName,Units,Format,Visible,Write En,Retain
N1,1111,Level_1,ft.,0,1,1,0
N2,0,Pump1_Temp,,0,1,1,0
N3,0,Pump2_Temp,,32,1,0,0
N5,0,Test_Register,,0,1,1,0
N6,0,Flow,,0,1,1,0
N11,0.0,I11,,114,0,0,0
B1,0,Pump1_Call,,1,0,0
B2,0,Pump2_Call,,1,0,0
B3,0,Pump1_Running,,1,0,0
B4,0,Pump2_Running,,1,0,0
```

Each line represents the information for a single register. The register information is delimited by commas. Values that should be left unaltered have no data between a pair of commas. The information fields are:

Restore Factory Defaults (Not IP)

Click on this button to restore the module configuration to the default settings as shipped from the factory. The Ethernet addressing and IOX Bus addressing information are not changed to avoid accidentally knocking you off of or impacting the module network.

Restore Factory Calibrations

Click on this button to restore the I/O calibration values originally determined and loaded at the factory.

Reset, Reset All Other Slots, Reset All

Click on these buttons to reset this module, or all of the other modules on the bus, or everything.

Power Saving

Ethernet Auto Power Down

Check this box to enable a power saving mode that saves as much as 30% to 40% power usage when an Ethernet cable is unplugged from the module.

Input Simulation Tests

Modulus modules have a built-in test mode to simulate digital and analog input signals. When enabled, each analog input reading is incremented every cycle time period until reaching maximum, then reset to zero. The digital inputs are turned on and off sequentially.

Test Mode Cycle Time (S)

This sets the rate that analog values increment and decrement, and digital points sequentially cycle on and off. The value is in seconds with a resolution of 100mS.

SD Card Operations

Modulus modules have a built-in slot that accepts a micro SD flash memory card. The module uses this card as flash disk and as storage for historical trend data. The disk must be formatted before it can be used. The formatting partitions the disk into two sections. The first section has a conventional file system that can be read and written by conventional desktop and laptop computers. The second half is configured for high-speed recording and retrieval of historical trend data.

Format SD Card

Click on this button to format the micro SD card. Any micro SD card used must be formatted in the module to set up the two partition sections described above.

File System Size (GB)

When the micro SD card is formatted, this is the size of the section that will be retained as a conventional file system. The remainder will be used for historical trending.

Backup Configuration the SD Card

Click on this button to save a backup copy of the module configuration and programming to the micro SD card. The configuration is saved as a conventional file that can be read by a desktop or laptop computer.

Programming

Program Reset Watchdog Enable

This option enables a program scan time monitor and Runtime Error reset recovery scheme. The system monitors the scan time of the program and by default (this option unchecked) will stop the program on any critical Runtime Error or when the scan time exceeds 10 seconds. When either of these conditions is detected the system will stop the program and log the error in the System Log. This will also annunciate a Programming Error Alarm if it is enabled.

With this option checked, the system under the same conditions will attempt to restart the program up to 5 times. After 5 restart attempts with an error occurring, the system will then stop the program and

log the inability to successfully restart in the System Log. User intervention will reset the counter by either downloading or just running the program from the web interface.

Caution: Use care when checking this option; program restarts reset all internal variables in the program. If control is actuated at a restart, the control will be re-actuated each time. For controlling pumps or other critical devices that require a rest before reactivating, on delay timers should be used to prevent backspin or other startup damage.

Program Auto Run

Usually when a system power cycle occurs if a program is written for the unit it is set to “Auto Run”. This is done in the programming editor. Turning off this option will cause the Auto Run to be turned off. A warning is also given that the currently running program will be stopped.

I/O Calibration

Under this tab, all analog signals readings in the module can be calibrated. Please contact ICL Technical Support for detailed procedures and information if you wish to do your own recalibration in the field.

Modulus SMS/Email Commands

This section defines the SMS text message or email message commands that may be used to interact with a unit’s POP3 account or Cellular modem SMS interface.

Text Command Formatting Rules

The Command Structure is :

[Command][Register]<-End Register><.SubCommand>< = Value>

Or

[TagName]<.SubCommand><=Value>

- Only one command or request per message.
- White Space is ignored.
- There is a 160 Character Packet size limit with the SMS Messages. If the response goes over this size then it will send as many messages as it takes to fill the request.
- To set a value, add an equal sign after the command followed by the value. Booleans can be set with either On/Off or 1/0.
- If Security is enabled, a user name and password need to be entered first. The format is .User.Password: <command>
- Ranges cannot be used with tag names.
- Users will be logged out after 10 minutes of inactivity
- Adding a ! before a value allows it to be written even from an Old Message

Table of Text Commands

Command	Description	R/W	Notes
HELP	Display Help		
?	Display All	R	Displays all visible DI’s, DO’s, AI’s, AO’s, Numbers

			& Bits
ACK	Acknowledge Alarms	W	Clears ALL Alarm Flag's
ALARMS	Show All Alarms	R	
GROUP	Alarm Group	R/W	Call Group; Holiday(1) or Normal(0)
ONCALL	List OnCall names	R	Shows Names and Numbers
MSG <message>	Relay a Message		Relay message to all OnCall
MSGE <message>	Relay a Message		Relay message to all OnCall & Elevated
MSGA <message>	Relay a Message		Relay message to Everyone in the Phone Book
ST	General Stats	R/W	VIN, Temp, CF, ect... ST=1 to Clear Stats
STB	Bus Stats	R	
STC	Cell Stats	R	
STE	Ethernet Stats	R	
STS	Serial Stats	R	
STM	Master Stats	R	
AI#	AI Scaled	R	
AO#	AO Register	R/W	
DI#	DI Register	R	
DO#	DO Register	R/W	DO1=On, DO2=1 both ways to turn on
I#, N#	N Register	R/W	N (Number) Registers
B#	B Registers	R/W	B (Bit) Registers
IR	Input Reg	R	Modbus Input Registers
OR	I/O Reg	R/W	Modbus Holding Registers
IB	Input Bool	R	Modbus Status Boolean Registers
OB	I/O Bool	R/W	Modbus Coils Boolean Registers
REPORT <name>	Run a Report	R	Run a ".rpt" Report. Trends and logs are disabled through SMS
<trigger name>	Set Trigger Bit	W	Set a Trigger that can be used in programming.
VER	Version & IP	R	
#APN <apn>	Forced APN	R/W	Can be set/cleared w/ =<apn> or =<blank>
#CELLDATA	Cell Modem Data Enable	R/W	Can be set/cleared w/ =On/=Off
#LOCALCFGONLY	Ethernet Local Config Only	R/W	Can be set/cleared w/ =On/=Off
#PROG	Set/Read Programming State	R/W	Can be set/cleared w/ =On/=Off
#PROGAUTO	Set/Read Programming AutoRun	R/W	Can be set/cleared w/ =On/=Off
#RESTART	Restart the unit	R	Restart after 3 seconds
#SECURITY	Security Enable	R/W	Can be set/cleared w/ =On/=Off
<Data En Key>	Data Enable Key	W	If setup, this will enable cellular data if it is turned off. This bypasses security.

Example Text Messages

STS

.User.pass: DO2=1

Digital Out 02=On

DI3=!on

Tag Names

Tag names for DI, DO, AI, AO, B and N registers will be translated to their equivalent registers. Examples

Digital In 01 = DI1

Technical Support

If you have questions, please contact support@iclinks.com or call 530 888-1800.