MODULUS

Cellular Communications Module 2110

Modulus Cellular Communications modules have a built-in 4G LTE cellular modem for data exchange over the Internet, alarming/notifications by e-mail and text message, and remote access They also support **wired** communications with Modbus, DF1, Ethernet IP, SDX, MQTT, and SDI-12.

The Cellular Communications modules have built-in analog and digital I/O for tank level and process monitoring, and pump control applications such as wells, lift stations and booster pumping stations. The modules have an analog input supporting both mA and voltage measurement. In addition, they have six discrete inputs (two high-speed and four optically isolated), three discrete outputs, and two analog outputs.

Modulus Cellular Communications modules have a single serial port (bus port). The bus port may be used for general purpose RS-485 communications when not bussed with other Modulus I/O modules.

Verizon Cellular Communications Module
8x-5011 2DI/PI, 1DO, 1AI (20mA/V)

AT&T & International Cellular Communications Module
8x-5012 2DI/PI, 1DO, 1AI (20mA/V)

Optional Field Wiring Panel

Modulus Cellular Communications Modules

- **1 ETHERNET PORT**
- **1 4G LTE CELLULAR MODEM (VERIZON OR AT&T / INT'L)**
- **2 SERIAL PORTS (1 GENERAL PURPOSE AND 1 BUS PORT)**
- **2 DISCRETE/HIGH-SPEED PULSE INPUTS**
- **1 DISCRETE OUTPUT (PROTECTED FET)**
- **1 ANALOG INPUT (mA,/V)**

STANDALONE OPERATION

Modulus Cellular Communications modules can serve as standalone devices with SCADA communications, local and web human machine interfaces (HMIs), historical trending and data logging, alarming, reporting, and programmable logic.

COMMUNICATIONS

Modulus Cellular Communications modules have a built-in 4G LTE cellular modem that can be ordered to support either Verizon or AT&T / international cellular networks. The also have an Ethernet port and one or two serial ports to communicate with Modbus devices and Allen Bradley PLCs. They can serve as communications concentrators or master controllers, as well as providing web and data access to any other Modulus modules on the high-speed bus. They support Ethernet to Serial bridging, and routing through Ethernet ports in other Modulus modules on the bus.

GRAPHICAL, MOBILE, AND LOCAL HMIs

Configurable graphical and mobile device web interfaces, including the tools and libraries to build custom screens, are built in. The front panel display can also be customized to show live process values and states, and make setting changes.

HISTORICAL TRENDING AND EVENT LOGGING

Modulus Cellular Communications modules have an internal flash disk, as well as a micro SD memory card slot to record over 100 years of data! Use built-in web tools to retrieve and display historical trend and event data and extract it as spreadsheet files.

REPORTING

Reports with custom graphics and logos can be created in minutes, showing live values, totals, trend/event data, alarm summaries, etc. They can be called up on demand, or sent out automatically.

ALARMING

A Modulus Cellular Communications module can manage alarm conditions on any of it's local inputs and other Modulus I/O on the bus, as well as external devices via communications. Alarms conditions can be displayed locally and annunciated by text message and e-mail alerts. Alarms can be acknowledged by text message or e-mail, discrete input, or local HMI button. The module maintains a journal spreadsheet file of when alarms occurred, when they were acknowledged, by whom, and when the alarm conditions clear.

PROGRAMMABLE LOGIC

Modulus Cellular Communications modules support programmable logic written in ladder logic, function block and text languages; all with 32-bit integer and floating point math. Programmable logic can supplement the built-in functions of the module.

PID & PUMP CONTROL

Modulus Cellular Communications modules have a quad PID controller and a triplex pump controller (float or level control) with error detection and alarming. The Cellular Communications Module is an ideal solution for SCADA operation of wells, lift stations, and booster pump stations.

REDUNDANCY

Modulus Cellular Communications modules support redundancy for enhanced reliability. If a module goes off-line, a designated backup can take over automatically.

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Modulus Cellular Communications Module - Type 2110- Specifications

FIELD I/O

Discrete Inputs:	**2**	High-speed, non-isolated DC or contact closure, DC to 20KHz maximum
Input Range:		Contact closure/open collector driver to ground, or 0 to 30Vdc (ON=<1.5V, OFF > 2.5V)
Input Current:		Approximately 0.5mA (internal current source)
Filtering		Individually configurable: 5Hz, 10Hz, 20Hz, 50Hz, 100Hz, 500Hz, 1KHz, 2KHz, 5KHz, 10KHz+
Discrete Output:	**1**	Solid-state Protected FET high-side drivers (switch to input power when ON)
Output Rating:		30Vdc, 2A maximum, current limited to approximately 2.25A.
Analog Inputs:	**1**	16-bit, Delta Sigma, individually software configurable ranges
Input Range:		• 20mA (minimum input for full accuracy is 0.5mA) • 5V, +/-5V, 10V, +/-10V, 30V

COMMUNICATIONS

Ethernet:	**1**	10/100mb/s (10/100 Base-T)
SCADA Protocols		Modbus TCP & UDP (master/slave), Ethernet IP (master/slave PLC5 & SLC5/05 emulation), SDX (AES-128 Encryption), MQTT, Ethernet to Serial bridging
Internet Protocols		HTTP (server), FTP (server & client), E-mail (SMTP and POP3), ICMP (ping; server & client), NTP (client), DHCP (server & client), DNS, DDNS
Cellular:	**1**	4G LTE: **[8x-5011]** 700(B13)/AWS1700(B4)/1900(B2) (Verizon)
		4G LTE: **[8x-5012]** 700(B12/B13)/850(B5)/AWS1700(B4)/1900(B2) (AT&T, T-Mobile, International)
SCADA Protocols		Modbus TCP & UDP (master/slave), MQTT
Internet Protocols		HTTP (server), FTP (server & client), E-mail (SMTP and POP3), ICMP (ping; server and client), DNS, DDNS
Serial:	**1**	RS-485 Bus port (this port is available for general purpose communications if not used for high-speed bus communications with other modules)
Baud Rates (all ports)		115K, 38.4K, 19.2K, 9600, 4800, 2400, 1200 baud.
Protocols		Modbus RTU (master/slave), DF1 (slave), SDI-12 (general purpose port only)

HMIs

Local:	128x32 graphical, wide temperature range yellow OLED and single pushbutton
Graphical:	Web based, graphic library included. Compatible with most browsers, including Internet Explorer, Firefox, Chrome, Safari, Android
Mobile:	Web based, text only, up to 50 registers. Compatible with most browsers, including Internet Explorer, Firefox, Chrome, Safari, Android

PROGRAMMING

Languages:	Ladder Logic, Function Block, Text—built-in web based graphical and text editor and debugger
Capacity:	64KB logic, 2MB source code, 32-bit integer and floating point math

STORAGE

Registers:	504 Numeric registers, 504 Boolean registers
Internal Flash disk:	32MB
Removable disk:	Micro SD Card (up to 256GB, supplied by customer)

CLOCK

Real Time Clock:	Temperature compensated with lithium battery backup power
Stability	+/- 3ppm from –30°C to 70°C

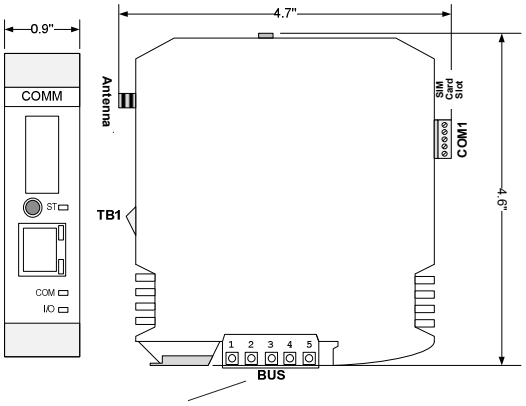
GENERAL

Input Power:	10Vdc to 30Vdc
Power Consumption	
Not using Ethernet	68mA @ 12Vdc / 40mA @ 24Vdc (Ethernet power saver enabled)
Using Ethernet	108mA @ 12Vdc / 60mA @ 24Vdc
Field Wiring Termination:	**[81-501x]** screw terminal blocks **[82-501x]** lever terminal blocks, 3.5mm, 22 to 14GA wires
Antenna Connector:	SMA female (female pin center conductor)
Temperature:	-40°C to 70°C (operating), -40°C to 85°C (storage)
Humidity:	<95% RH (non-condensing)
Enclosure:	Polyamide, light gray (RAL 7035)
Mounting:	35mm DIN rail with bus connector block

Specifications subject to change without notice. Consult factory to ensure that you are working with current information.

Modulus Cellular Communications Module - Type 2110—Antenna Wiring

DIMENSIONS and CONNECTIONS

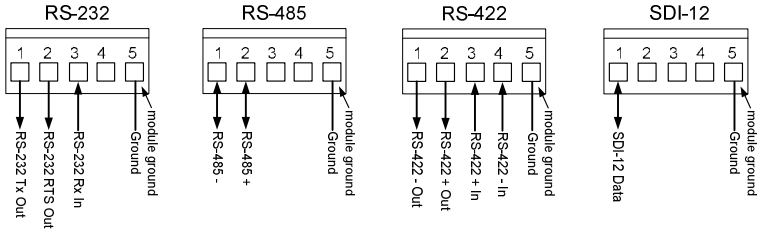


Terminal	Function
1	-485
2	+485
3	RESET#
4	GND
5	+V

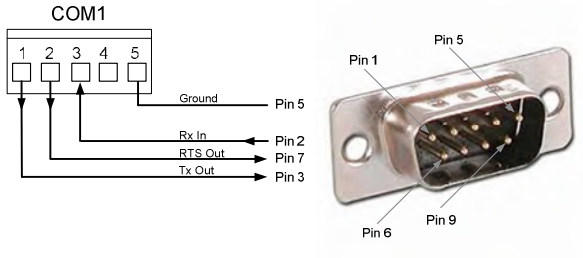
Terminals	TB1
1	DI1
2	AI1
3	AI2
4	DO1
5	GND

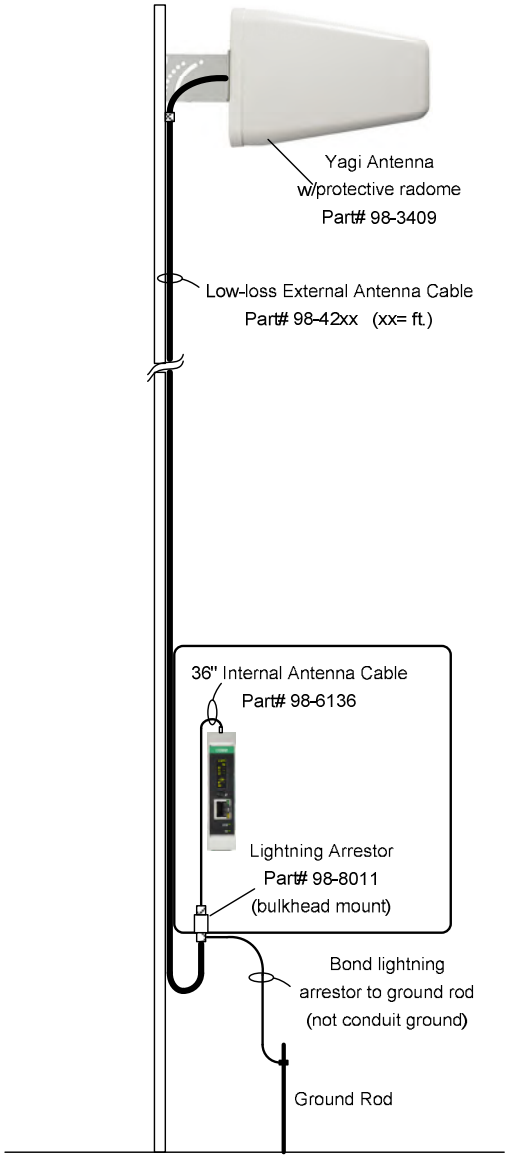
General Purpose Communications Port COM1

(modes are software configured)



Typical COM1 RS-232 Wiring to Modem/Radio





Antenna System Options

Most cellular based systems typically have less costly and complex antenna system requirements. The choice of antenna components depends on the type of enclosure housing the enclosure (metallic or non-metallic) and the proximity to the nearest cellular tower.

Non-metallic Enclosure

When installed in a non-metallic enclosure, the simplest and lowest cost antenna solution is a whip antenna screwed directly into the SMA antenna connector on the module. The part number is **98-3411.**

Metallic enclosure—standard.

If the module is installed in a metallic enclosure, many applications can use a low-cost "salt-shaker" style antenna (part number **98-3402**), mounted on the enclosure. The antenna is connected to the communications module with a short internal antenna cable (part number **98-6136**).

"salt shaker" antenna

Metallic enclosure—difficult reception areas.

Sometimes, the site location may not be close to the carriers cellular tower. This may require a higher performance antenna system using a Yagi directional antenna elevated on a support pole or structure.. You will need to aim the antenna towards the desired cellular tower (the carrier can help you identify the tower location). A lightening arrestor is generally recommended since the antenna is elevated, making it a better "target" for a lightning strike. Use a dedicated grounding rod and bonding as shown for the lightning arrestor.

Antenna System BOM:

98-6136	36" Internal Antenna Cable
98-8011	Lightning Arrestor
98-42xx	Low-loss Antenna Cable (xx= length in feet)
98-3409	Cellular Yagi Antenna w/ weather radome
98-9002	Weatherproofing Kit (for external antennal connections)

  Industrial Control Links, Inc., Roseville, CA **530.888.1800**

Modulus Cellular Communications Module - Type 2110 - Field Device Wiring

⚠ Refer to the installation manual for additional installation details and precautions.

Discrete Inputs DI1 & DI2, Discrete Output DO1 & Analog Input AI1 - TB1

The field wiring may be connected directly to the TB1 terminal block, or through a field Wiring Panel as shown in the diagrams below. All discrete inputs/outputs and the analog input are referenced to the ground terminal (5). This terminal is connected internally to the power supply ground.

The Discrete Inputs accept contact closures or open-collector ("NPN" style) input signals. External pull-up resistors are not required.

The Discrete Output sources current by switching the module input power to the output terminal.

The analog Input accepts 20mA current or voltage (+/-5v, +/-10v and 30v) signals. The mode is software selectable. Sensors can be either loop powered (Figure A) or self-powered (Figure C). In power conserving applications, the analog sensor may be powered from the Discrete Output (Figure B), configured to switch power to the sensor only when needed to take an analog reading (with configurable "warmup" time (a 20mA loop powered sensor is shown below, but a voltage sensor can also be used by switching its power).

Note that for all configurations, the model 82-00xx Field Wiring Panel is used.

FIGURE A
20mA Loop Powered Sensors
External Loop Supply

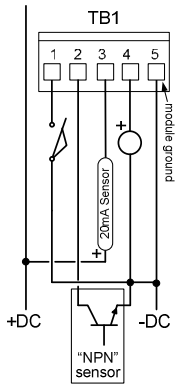


FIGURE B
Analog Sensor Power
from Discrete Output
(power saver)

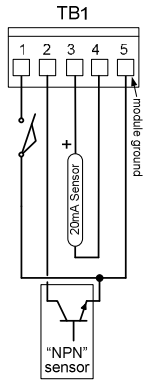
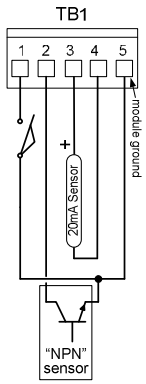
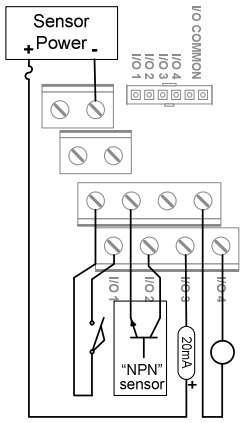


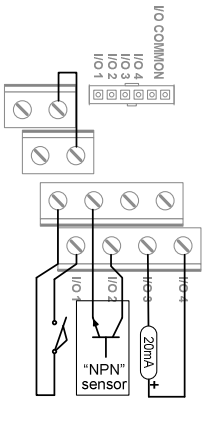
FIGURE C
Self-powered
Sensors



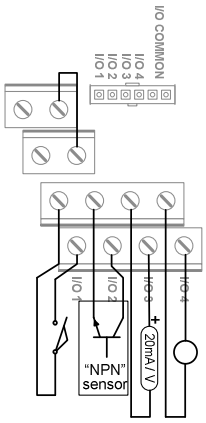
82-00xx Field Wiring Panel



82-00xx Field Wiring Panel



82-00xx Field Wiring Panel



Optional Field Wiring Panel

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