905U / 105S
Telemetry Modules

900MHz Industrial Wireless Solutions for PLC and SCADA Process Automation.

The ELPRO 905U / 105S range of wireless I/O provide remote monitoring and control by radio or twisted-pair wire, over short or long distances. Transducer signals connected at one module (input signals) are transmitted to another module where the signals are re-created as output signals, or passed via RS232 / RS485 to a host device such as a PLC or SCADA system.

Easy To Use
The ELPRO 905U / 105S range of telemetry modules have been designed to be easy to use and simple to install. The modules include power supply, microprocessor controller, input/output (I/O) circuits, radio transceiver and/or serial transceiver (RS485/232). The 905U/105S modules are completely integrated and ready for use. They are housed in a strong extruded aluminium case, with plug in terminal strips for ease of wiring connection and maintenance.

905U Wireless I/O Modules
The ELPRO 905U radio telemetry modules are a low cost alternative to cable installations. The 905U provides a wireless radio link for digital (switch contact), pulse and analog signals. As well as radio communications, the 905U has a port for RS485 multidrop twisted pair cable, enabling communications to 105S serial telemetry modules.

105S Serial I/O Modules
The 105S range of modules provide communications via RS485 multidrop. RS485 is a method of transmitting between many devices using a common twisted pair wire. The maximum length of the wire is typically 2000 metres. This method of communications is particularly suitable for enclosed factory environments, where distances between modules are not very far, however radio paths may be obstructed. 105S modules may be used as a separate multi-drop I/O system, or as I/O expansion for 905U modules.

In factories or building environments, groups of 105S modules, connected by RS485 multidrop, may also transmit information by radio to another remote multidrop group in another building. For example, several buildings on a large site may be connected by radio links, with signals inside the buildings being conveyed by multidrop twisted-pair.

Simple but Reliable
The ELPRO 905U modules use a very reliable transmission protocol designed for secure communications, even with external interference. Because 905U modules have transceivers, modules are able to communicate with each other to control the flow of information.

Transmissions occur when an input signal changes. That is, when a digital (switch contact) input turns off or on, or when the value of an analog input changes by a pre-configured amount. The 905U provides real-time communications, which polling systems cannot achieve.
There are also regular update transmissions to check the value of the input signals and to check the integrity of the communication path. The status of the communications path is available as an alarm output.

The input signals are transmitted in a "data frame" which includes the address of the transmitting module, the address of the destination module, and a CRC error check. The error check is used to ensure that there is no corruption of the data frame during transmission.

Each module will wait until the radio channel is "free" before transmitting a message. When the destination module receives the message, it will check the validity of the message and transmit a return acknowledgment - a "handshake". If the original module does not receive this acknowledgment, then it will resend the message another four times on four different radio channels. Using this simple but secure communications protocol, the 905 provides reliable operation even in noisy environments.

Two-way Communications
The 905U internal radio is a transceiver - a transmitter and receiver. Because the 905U can communicate in both directions, each module is capable of both input and output signals. Both monitoring (input) and control (output) functions are provided on every 905U module.

Variety of I/O Configurations
The 905U / 105S range of products include modules with various I/O configurations. All modules in the ELPRO 905U / 105S range include the same flexible and reliable operating protocol. Different versions will operate together in the one system. Each module provides different combinations of the following I/O:

- digital inputs for switch devices such as limit switches, level switches, security sensors, motor starters, pushbuttons
- analog inputs (0-10 / 0-20 / 4-20 mA) for connecting transducers which measure parameters such as level, flow, pressure, temperature, vibration
- digital output contacts for controlling devices such as motor drives, lights, alarms
- analog outputs (0-10 / 0-20 / 4-20mA) for connection to meters or indicators to display measured parameters.
- pulse inputs and outputs for transmitting pulse signals from flowmeters, energy meters etc. on any other modules.

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<th>905U-1</th>
<th>105S-1</th>
<th>905U-2</th>
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Pulse and digital I/O are same
The 105-4 has 4 fixed inputs and 4 fixed outputs and 12 which may be either input or output

Networking
Each ELPRO 905U / 105S module is configured with a system address and a unit address. Only modules with the same system address will communicate within the same system.
More than one system may operate within radio range or on the same multidrop wire without "cross-talk" or malfunction. A system may comprise a simple two unit network, with input signals at one module appearing as outputs at the other. Or a system may comprise up to 95 905U modules communicating by radio, with each module connected to up to 31 105S modules via RS485. Any input may be configured to be transmitted to an output on any other module.

**Interfacing to Other Systems**
A 905U network may also connect via RS232 or RS485 to a host device such as a supervisory computer or PLC. The host device will receive the status of input signals, and may set the value of output signals. Interfaces are available for many PLC's and SCADA software packages.

**Pulse I/O**
The 905U modules may be configured to count a pulse input and transmit the accumulated count to a remote module. At the destination module the pulse signal is recreated - the accumulated value is used to ensure that all input pulses are output accurately. The 905U can also transmit the pulse input rate as a separate analog value and the rate signal is provided as an analog output at the destination module.

**Example Network's**

![Network Diagram]

**Analog I/O**
The 905U-1 modules have two inputs which will accept 4-20mA analog signals. One of these inputs has adjustable setpoints for controlling a digital output.

The 905U-2 modules have six inputs which will accept 0-20mA analog signals. Because of the inputs' high resolution, they may be used for 4-20mA signals or 0-10mA signals. Each analog input has adjustable setpoints for controlling digital outputs.

The 905U-3 modules provide eight analog outputs with a range of 0-20mA. These outputs will reflect the same value as the analog input signal.

**Analog Setpoints**
High and low setpoints may be configured for the analog inputs to control a remote digital output contact. The digital output will set ("on") when the analog input value drops below the low setpoint and will reset ("off") when the analog value exceeds the high setpoint.

**Radio Communications**
The ELPRO 905U radio transceiver operates in the 902 - 928 MHz Spread Spectrum UHF band. The
905U radio is available with transmit power of 1W, and meets the radio regulation of US FCC Part 15 Class A and FCC Part 15.247. The 905U has been designed to operate reliably on an open channel with other users.

The 905U provides an indication of reliable radio signal strength to assist with installation and testing.

**Radio Range**

The average radio range of the 905U is 15 miles line-of-sight with 6dB gain antennas. Longer distances can be achieved subject to local conditions.

The 905U provides an indication of reliable radio signal strength to assist with installation and testing. Each 905U also provides a repeater function. A module may be configured to retransmit a message on to a remote module which does not have a reliable radio path.

The repeater acts as an intermediate module between the two ends of the radio link. Messages may be repeated up to five times by intermediate repeater units, allowing very long radio paths to be achieved. Repeaters can also have their own I/O.

**Power Supply**

The ELPRO 905 modules include a switch-mode power supply which will accept a variety of voltage sources. The 905U will operate from a DC supply of 11 to 30 volts or an AC supply of 15 to 24 volts.

The power supply includes a battery charger for backup batteries, and a solar regulator for direct connection of solar panels. The 905 power supply is intelligent and will automatically alarm on loss of mains supply, loss of solar charging or low battery voltage. These alarm signals may also be transmitted to remote modules as digital output signals.

**Configuration**

The 905U modules are easy to configure, using on-board selection switches, or by connecting a PC to the module serial port and downloading a configuration file. Configuration software is provided with the modules. Configuration files may be uploaded from the modules for modification or archival.

**Diagnostics, Testing**

The 905 modules provide diagnostic and test functions by connecting a PC terminal to the module. I/O and communication functions may be tested. The 905U module includes a radio strength measurement, which provides an indication of background noise and received radio strength.

This feature allows radio paths to be tested without any additional test equipment.

**Specifications**

**General**

- Class 1 Div 2 certified (USA/Canada)
- Environmental -40 to +140 degF, -40 to 60 degC, 0 to 99%RH
- EMC Compliant FCC Part 15 Class A
- Housing - extruded aluminium case 130 x 185 x 60mm with DIN rail mounting (1050g packed)
• Removable terminal blocks for ease of module replacement
• Terminals suitable for 2.5sqmm conductors
• LED indication for power supply, Watch Dog Timer, digital I/O, radio TX and RX.

Inputs and Outputs

• Digital Inputs
  opto-isolated (5000V) inputs suitable for voltage free contacts or NPN transistor, contact wetting current 5mA
  905U-1 / 105S-1 four inputs
  905U-2 / 105S-2 four inputs
  905U-4 / 105S-4 up to 16 inputs (4 inputs + 12 selectable I/O).
The 12 selectable inputs are surge protected but not isolated.

• Digital Outputs
  905U-1 / 105S-1 four relay output contact, normally open, DC 30V 2A, AC 50V 5A
  905U-2 / 105S-2 one FET output 30VDC 500mA
  905U-3 / 105S-3 eight FET output 30VDC 500mA
  905U-4 / 105S-4 up to 16 FET output (4 outputs + 12 selectable I/O)

• Analog Inputs
  "floating" differential inputs, common mode voltage 27V, 24VDC for powering external loops provided, digital filtering 1 sec.
  905U-1 / 105S-1 two 4-20mA resolution 15 bit, accuracy 0.1%
  905U-2 / 105S-2 six 0-20mA resolution 12 bit, accuracy 0.1%

• Analog Outputs
  current sink to common, max loop voltage 27V, max loop resistance 1000 ohms
  905U-1 / 105S-1 two 4-20 mA resolution 15 bit, accuracy 0.1%
  905U-3 / 105S-3 eight 0-20 mA resolution 12 bit, accuracy 0.1%

• Pulse Inputs
  Specifications as per digital inputs
  Max pulse rate 100Hz, pulse width min 5 ms
  905U-1 / 105S-1 one input (DI1)
  905U-2 / 105S-2 four inputs(DI1-4) - first pulse input (DI1) max 1000Hz, pulse width min 0.5ms
  905U-4 / 105S-4 four inputs(DI1-4) - first pulse input (DI1) max 1000Hz, pulse width min 0.5ms

• Pulse Outputs
  FET 30VDC 500mA max 100Hz
  905U-1 / 105S-1 one
  905U-3 / 105S-3 four (DO1-4)
  905U-4 / 105S-4 four (DO1-4)

Power Supply

• Battery supply 11.3-15.0 VDC
• Normal supply 12-24 VAC or 15-30 VDC, overvoltage and reverse power protected
• Mains supply 110-250 VAC available via plug-pack transformer
• Battery charging circuit included for 1.2-12 Ahr sealed battery
• Solar regulator for direct connection of solar panel (up to 30W) and solar battery (100Ah)

• Current drain:-
  905U-x (12V) is 85mA + (10mA per active digital input) + (25mA per active digital output) + (analog I/O loop mA x 2).
• Internal monitoring of mains fail status, solar charge status, and battery voltage. These values may be transmitted to remote modules for monitoring.
• An internal inverter provides 24VDC 150mA for analog loop supply.
Radio Transceiver

- Frequency Hopping Spread Spectrum Transceiver
- Frequency USA/Canada 902 - 928 MHz, Australia 915 - 928 MHz, NZ 921 - 928MHz
- Frequency hopping, hopping sequence 8 x 50
- Transmit Power 1W
- Error Correction - automatic retry with 16 bit CRC
- RSSI -60 to -120 dBm
- RF Data Transmission Rate - 19200 baud
- Signal Strength Indication -120 dBm to -80 dBm
- Expected line-of-sight range, depending on local conditions USA/Canada 20+ miles, Australia/NZ 20+ km
- Range may be extended by up to 5 repeaters
- Conforms to FCC Part 15 Class A and FCC Part 15.247
- Antenna connection is SMA coaxial

Serial Port

- RS232/RS485 serial port 9600 baud, 8 bits, no parity, 1 stop bit
- RS232 9pin DB9 female connector
- RS485 max cable distance 2000 m terminal connections

Data Transmission

- Data transmission on "change-of-state" of inputs as well as integrity update transmissions.
- The period for update transmissions is configurable. Data transmitted as bit stream data frame using a synchronous protocol with 16 bit CRC error checking. Automatic acknowledgment of error-free transmissions with up to 5 retries before communications fail is set.
- Communications failure status may be configured as a digital output. Resetting of outputs on communications failure is configurable.
- Transmission rates Radio 19200 bd Serial 9600 bd
- Typical radio message transmission time 40ms