EL-115S-XX

USER MANUAL

ELPRO Technologies

QUANTUM EDGE | CONDOR | LEGACY

115S-XX

Serial Expansion modules

Thank you for your selection of the 115S Serial I/O Module. We trust it will give you many years of valuable service.

ATTENTION!

Incorrect termination of supply wires may cause internal damage and will void warranty.

To ensure your 115S product enjoys a long life,

Double check ALL your connections with the User Manual, before turning the power on.

All equipment must be **properly grounded** for safe operation.

All equipment should be serviced only by a **qualified technician**.

Important Notice

ELPRO products are designed to be used in industrial environments, by experienced industrial engineering personnel with adequate knowledge of safety design considerations. These products should not be used in non-industrial applications, or life-support systems, without consulting ELPRO Technologies first.

Installation and Operating Instructions:

The Expansion I/O modules are to be installed by trained personnel / licensed electricians only and installation must be carried out in accordance with the instructions listed in the Installation Guide and applicable local regulatory codes.

The units are intended for Restricted Access Locations.

The Expansion I/O modules are intended to be installed in a final enclosure, rated IP54, before use outdoors.

The Equipment shall be powered using an external Listed Power Supply with LPS outputs or a Class 2 Power Supply.

Hazardous Location Notices:

This device complies with 2014/34/EC – ATEX Directive
Ex ec IIC. T5 Gc
-40°C <= Ta <= +60°C

IECEx LC XX.XXXXX
Ex ec IIC Gc
10.8-30VDC, 1000mA IP20
-40°C <= Ta <= +60°C

WARNING: EXPLOSION HAZARD.
Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Limited Lifetime Warranty, Disclaimer and Limitation of Remedies

ELPRO products are warranted to be free from manufacturing defects for the "serviceable lifetime" of the product. The "serviceable lifetime" is limited to the availability of electronic components. If the serviceable life is reached in less than three years following the original purchase from ELPRO, ELPRO will replace the product with an equivalent product if an equivalent product is available.

This warranty does not extend to:

- failures caused by operation of the equipment outside the particular product's specification, or
- use of the module not in accordance with this User Manual, or
- abuse, misuse, neglect or damage by external causes, or
- repairs, alterations, or modifications undertaken other than by an authorized Service Agent.

ELPRO's liability under this warranty is limited to the replacement or repair of the product. This warranty is in lieu of and exclusive of all other warranties. This warranty does not indemnify the purchaser of products for any consequential claim for damages or loss of operations or profits and ELPRO is not liable for any consequential damages or loss of operations or profits resulting from the use of these products. ELPRO is not liable for damages, losses, costs, injury or harm incurred as a consequence of any representations, warranties or conditions made by ELPRO or its representatives or by any other party, except as expressed solely in this document.

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Overview

The ELPRO 115S modules provide I/O expansion for the ELPRO Legacy I/O based products (105U and 905U modules) as well as the Condor Range (915U-2, 925U-2, 415U-2, 415U-E, 215U-E radios and the 115E-2 Etherenet I/O). The 115S modules supports the older ELPRO Legacy E-Series protocol, and communicate serially via RS232 or RS485. Configuration is done via the ELPRO E-Series configuration utility.

The 115S modules also supports MODBUS protocol which is the method of communciation for the newer Condor range products mentioned above. They may also be used as a MODBUS slave with any 3rd-party MODBUS device, or with the ELPRO Legacy 105U-G or 905U-G modules using MODBUS. They support both MODBUS ASCII protocol, and serial un-signed MODBUS RTU, also known as "MODBUS binary". The Modbus slave address of the 115S is selected via two rotary switches on the bottom panel of the case.

All 115S models provide digital inputs and outputs. Specific models provide analog inputs or analog outputs. Pulsed inputs and pulsed outputs are also available. Several modules may be connected to one master, allowing any combination of I/O types.

Figure 2-1 shows a diagram of a 115S module with parts labelled.

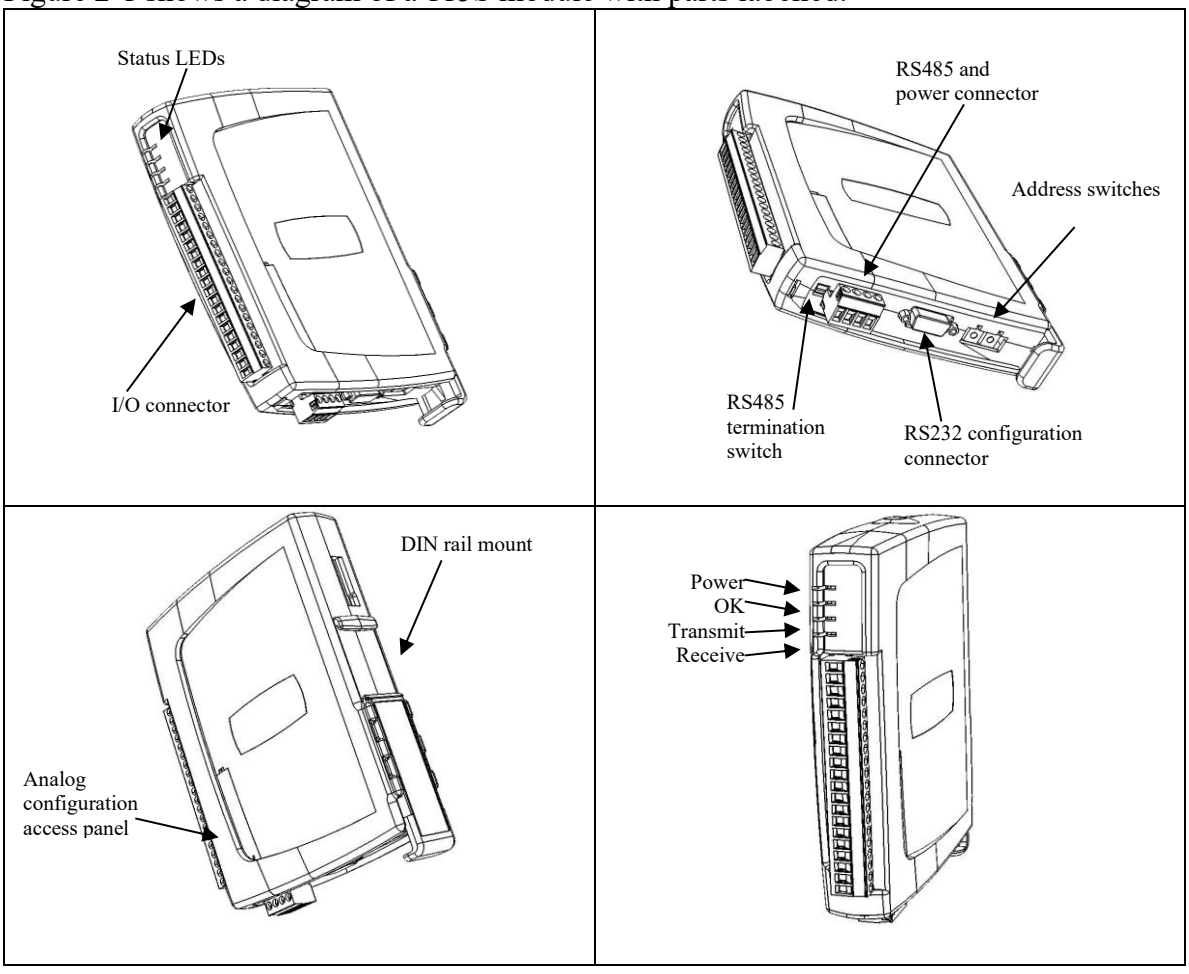

Figure 2-1: 115S unit with significant parts labeled.

Two ports allow configuration and communications on the 115S. The RS232 port is intended for configuration. The RS485 port allows the unit to be in a multi-drop configuration.

Overvoltage protection and supply monitoring is provided to minimize the risk of failure due to faulty connections or supply surges.

1.1 Module types and features

The module types and I/O are summarised in Table 2-1.

115S	-11	-12	-13
Digital inputs/outputs	16	8	8
Pulse outputs	8	8	8
Pulse inputs	4	-	-
Analog inputs	-	8	-
Analog outputs	-	-	8

Table 2-1: Summary of 115S module types and I/O.

1.1.1 Digital inputs / outputs

Each digital I/O channel on the 115S modules can act as either an input or an output. The input/output direction does not need to be user configured.

Digital inputs are suitable for voltage-free contacts, or NPN-transistor switch devices.

Digital outputs are open-collector transistor outputs, able to switch loads up to 30VDC, 200mA.

If you have wired an input/output channel as an input, it is recommended that you do not write values to it as an output. No electrical damage will occur if you attempt to use a channel wired as an input as an output, or vice-versa, however the I/O system will not operate correctly.

We recommend that the required digital inputs be assigned consecutively from channel 1. Then use the remaining channels as digital outputs.

1.1.2 Pulsed outputs

The first eight digital channels on each 115S module can be used as pulse outputs. The maximum output frequency is 50Hz.

A pulse output on the 115S will output the number of pulses equal to the register value sent by the master. When the master sends a new register value, the 115S will output additional pulses until the output count is the same as the new value.

Three register values are associated with creating each pulsed output:

- The *Count* keeps a tally of how many pulses have been output - this is a 16-bit register and overflows to 0.
- The *Target* is set by the master, and is the trigger for pulses to be created. The digital channel outputs pulses until the *Count* value reaches the *Target* value. If the *Target* register is set to 0, the pulses stop and the *Count* register is cleared.
- The *Update Time* is the interval in which the 115S expects to receive updates to the *Target* value. The module will output enough pulses for the *Count* to reach the *Target* within the update time. The output pulse rate is determined by the update time, and the difference between the count and the target.

If the calculated pulse rate is more than the maximum rate (50Hz), the 115S will output pulses at the maximum rate. At the end of the update time, the count value will be less than the target. The 115S will then calculate the new required pulse rate for the next update period, based on the difference between Count and Target values.

If the calculated pulse rate is greater than around three times the maximum rate, pulses are not output. The Count value will be set to the value of the Target without any pulses output. Pulses will be output again when the calculated pulse rate falls within the maximum possible rate.

1.1.3 Pulsed inputs

The first four digital channels on the 115S-11 module can be used as pulsed inputs. The maximum input pulse frequency is 1 KHz.

The pulse input channel calculates two register variables, each of which can be read by the Modbus master.

- The *Pulse Count* is a count of the pulses detected on the channel since the 115S powered up. The pulse input counts are 32-bit values (2 x 16-bit registers, a low and a high register), and wrap around to zero on overflow.
- The *Pulse Rate* is a measure of the rate of pulses detected on the channel. The pulse rate value is decimal 16,384 (hex 4000) for zero rate and decimal 49,152 (hex C000) for the *maximum rate* configured by the user. These zero and maximum values are the same as 0% and 100% used for analog values. (See section 5.4 for hex to decimal conversion.)

The maximum pulse input rate is set during configuration. The value is in pulses per minute and is limited to 60000 (1 KHz), the maximum rate capable of the module.

1.1.4 Analog inputs

The analog inputs on the 115S-12 can be connected as either grounded single-ended inputs or as floating differential inputs. The 115S-12 has eight grounded inputs or four floating inputs.

- Grounded single-ended inputs connect between the AIN terminal and the GND terminal.

- Floating differential inputs each take up two terminals. There are four differential pairs on the 115S-12: [AIN1-AIN2], [AIN3-AIN4], [AIN5-AIN6], [AIN7-AIN8]. For example, the first input is connected to terminals AIN1 (positive) and AIN2 (negative).

The two types of input cannot be mixed - all inputs must be either “grounded” or “floating”.

Inputs can also be selected as mA current, or voltage input - all inputs must be the same, either all current or all voltage. The scale of each analog input is chosen during hardware configuration, with scale options as follows:

Voltage input scale options: [0 to 5V], [0 to 10V], [1 to 5V]

Current input scale options: [0 to 10mA], [0 to 20mA], [4 to 20mA]
For compatibility with E-Series modules, 4-20mA current is recommended. See section 4.4 for more information on compatibility.

The values on the analog input are decimal 16,384 (hex 4000) for minimum signal (0%) and decimal 49,152 (hex C000) for maximum (100%).

The analog channel will measure over-scale, up to 150% which will have value 65,536 (hex FFFF). For 4-20mA signals, the channel will measure under-scale down to 0mA which has a value of 8,192 (hex 2000). (See section 5.4 for hex to decimal conversion.)

The 115S-12 provides a 24V analog loop supply ("ALS") for powering analog loops.

1.1.5 Analog outputs

The 115S-13 has eight analog output channels and can be configured to output voltage or current. For current signals, "source" or "sink" can be selected. The scale of each analog output is specified during configuration, with scale options as follows:

Voltage output scale options: [0 to 5V], [0 to 10V], [1 to 5V]
Current output scale options: [0 to 10mA], [0 to 20mA], [4 to 20mA], source or sink

- Voltage outputs are measured with respect to the ground terminal.
- Current source outputs are measured with respect to the ground terminal.
- Current sink outputs are measured with respect to the 24V "ALS" terminal.

Writing to the output register by the master produces the analog output. Minimum to maximum signals (0 – 100%) are produced by register values from decimal 16,384 to 49,152 (hex 4000 - C000). (See section 5.4 for hex to decimal conversion.)

The analog channel can output over-scale, up to 150% corresponding to register value 65,536 (hex FFFF). For 4-20mA signals, the channel can output under-scale down to 0mA from a register value of 8,192 (hex 2000) or less. Note that the over-scale output is limited by the maximum levels capable of the 115S module (12V or 24mA).

1.1.6 Communications

The 115S modules have two communication ports: RS232 and RS485. Both ports support Modbus protocol and the older Elpro Legacy protocol.

The RS232 port is generally intended for configuration and diagnostics. The RS485 port is intended for normal communication and can be used in a multi-drop setup.

There are two address switches on the base of the module. When the switches are set within the range 01-99, the module uses Modbus protocol on the RS485 port, with the Modbus address defined by the switches. This is the default communication method for the Elpro Condor Range of products. Setting both address switches to 00 configures the module to use the Older Legacy

E-Series protocol on the RS485 port. Whenever these address switches are changed the unit should be reset by disconnecting power.
Note - When configured for E-Series protocol the maximum number of expansion modules per radio is 10 as each module requires 3 addresses and the port settings are fixed at 9600 baud, 8 Dats bits, no parity & 1 stop bit.

The Modbus communications settings are configurable as follows:
Modbus type: RTU, ASCII with 8 data bits, ASCII with 7 data bits. (Note that the configuration software only supports Modbus RTU. A Modbus Master can select ASCII protocol by writing to the appropriate register. See Appendix A.)
Baud rate: 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200
Parity: none, odd, even
Stop bits: 1 or 2.

The modules are fitted with a termination switch for the RS485. Set this switch only on the last module in a multi-drop RS485 configuration.

The ELPRO configuration software (E-Series, Mconfig & Cconfig) is used to configure the 115S modules. The hardware set-up for items such as expected pulse rates and analog signals is also available through this software.

When used as a Modbus-Slave only device, stand-alone configuration software (cfg_115S_Vx.xx.exe) is available to set up the modules. All required software may be downloaded from the ELPRO website.

2 Installation

All connections to the module should be SELV only. Normal 110/220/240V mains supply should not be connected to any input terminal of the module.

2.1 General installation

Several 115S modules may be connected to one Master / E-Series or Condor Radio via RS485 multi-drop connection as shown in Figure 2-1. Ensure there are good connections between the 115S units and the master and a separate Earth connected to the 'GND' terminal on the front Terminal block of each module. 2.5 sqmm / 12 gauge earth wire is recommended.

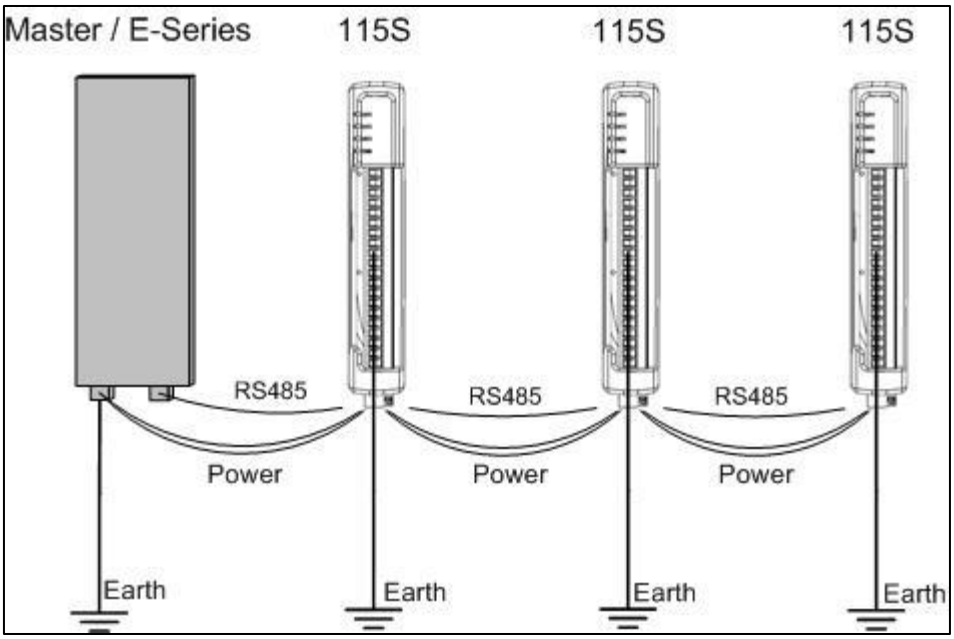

Figure 2-1: Several 115S units connected to a master.

2.1.1 Power Connection

The 115S modules require a 10.8-30 VDC ** power supply. This is supplied to the 4-way connector, shown in Figure 2-2.

***** Model Dependent. Check rear label for actual operating voltages***

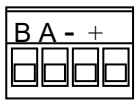

Figure 2-2: Power and RS485 connector.

Connect 10.8-30 VDC to + and earth to -. Connect RS485 to B and A.

2.1.2 Address Switches

The address switches are found on the bottom panel of the module, as shown in Figure 2-3. If you are using the 115S module with ELPRO Legacy E-Series modules (ELPRO 105 and 905 modules), the address switches **must** be set to "00". This enables ELPRO protocol mode and assigns 3 serial addresses to each module.

If you are using the 115S module with the Condor Range (915U-2, 925U-2, 415U-2, 415U-E, 215U-E radios and the 115E-2 Etherenet I/O) or as a Modbus Slave for a stand alone Modbus Master, ensure each 115S connected has a unique Modbus address on the rotary switches.

Note that the module must be reset after changing the address switches.

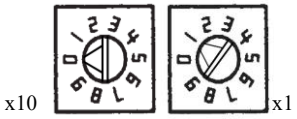

Figure 2-3: Address switches. The address shown is 01.

Connect the RS485 B and A wires to the 4-way connector shown previously in Figure 2-2. An RS485 termination switch is provided. Terminate the last 115S module in the multi-drop setup as shown in Figure 2-4.

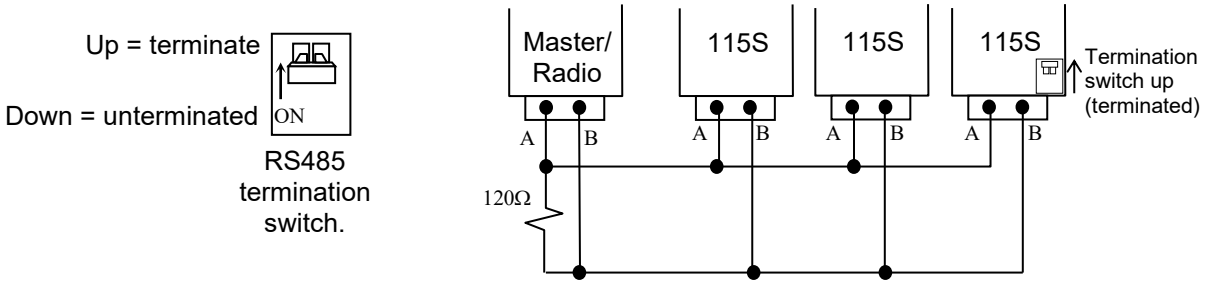

Figure 2-4: RS485 multi-drop connection and termination (only use external termination for the master if it does not have internal termination).

2.2 Signal Connections

All connections to the module should be SELV only. Normal 110/220/240V mains supply should not be connected to any input terminal of the module.

2.2.1 Digital Inputs (and Pulsed Inputs)

The 115S-11 supports 16 digital signals, and the 115S-12 and 115S-13 support 8 digital signals. Additionally, digital inputs DIO1-4 on the 115S-11 operate as pulse inputs.

Digital output signals share the same terminals as the Digital input signals, marked DIO1-8, and DIO1-16 on the 115S-11 module.

A digital input is activated by connecting to EARTH, either by voltage-free contact or by a transistor switch. Refer to Figure 2-5:

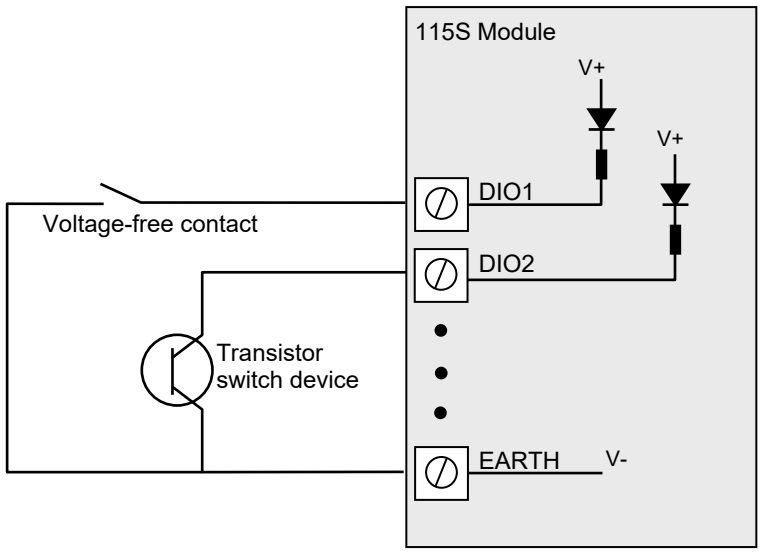

Figure 2-5: Connection of digital inputs.

2.2.2 Digital Outputs (and Pulsed Outputs)

The 115S-11 supports up to 16 digital outputs, shared with the digital input function on the same terminals. The 115S-12 and 115S-13 both provide 8 digital output signals. These signals are marked DIO1-8, and DIO1-16 for the 115S-11. On all 115S modules, DIO1-8 can also operate as pulsed outputs.

When active, digital outputs provide a transistor switch to EARTH. To connect a digital output, refer to the diagram in Figure 2-6. A bypass diode is recommended to protect against switching surges for inductive loads such as relay coils.

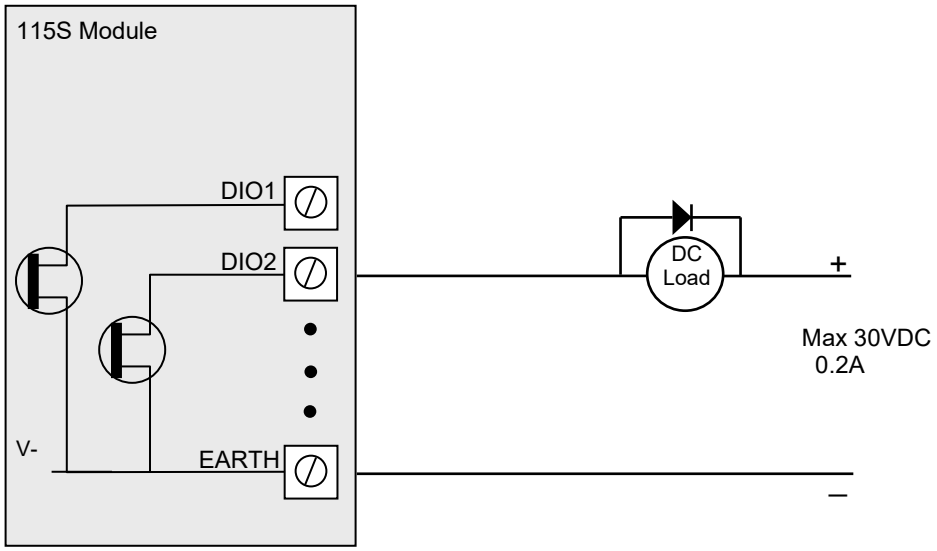

Figure 2-6: Connection of digital outputs.

Note that digital outputs will only switch DC circuits, with maximum voltage 30VDC.

2.2.3 Analog Inputs

The 115S-12 provides eight grounded single-ended or four floating differential analog inputs. These provide measurement of voltage signals (0-10V) or current (0-20 mA) signals. An internal 24V analog loop supply (ALS) is generated for current loops.

Refer to Section 4.4 for detail on configuring single-ended, differential, current-mode or voltage mode inputs.

2.2.3.1 Grounded Single-Ended mA Inputs

Single-ended current inputs allow twice as many inputs as the differential mode. This mode is useful when the sensor loop can be grounded to the 115S module. Devices may also be powered by the 24V supplied by the 115S. Refer to Figure 2-7:

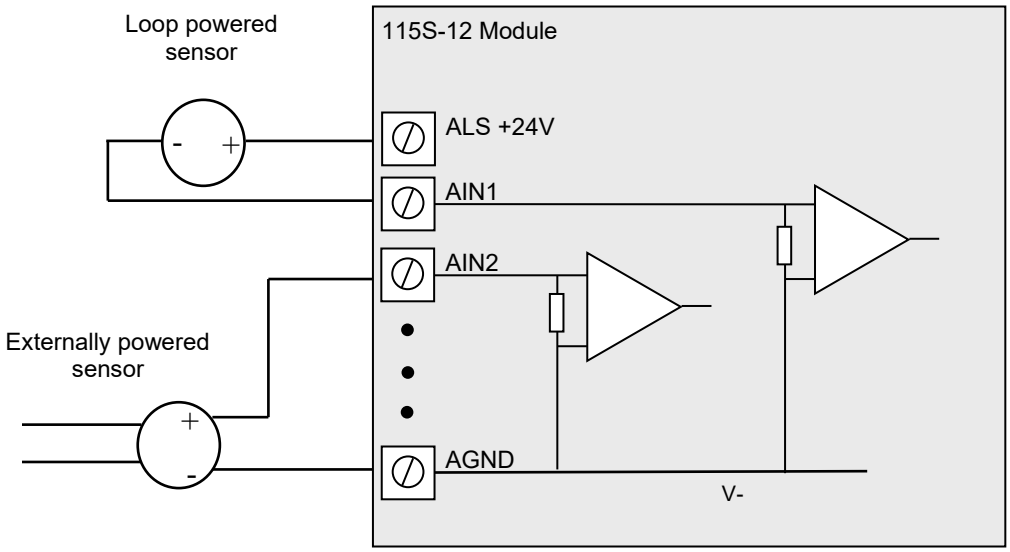

Figure 2-7: Connection for single-ended current inputs. Transducers may be externally powered or powered by the 115S +24V loop supply.

Note:

- The module is configured at the factory for this type of input
- To change the input configuration, refer to section 4.4

WARNING !

Ensure correct DIP switch positions AND software configuration has been completed for each analogue input BEFORE connecting external signals to the 115S-12 module.

2.2.3.2 Floating Differential Mode mA Inputs

Differential mode current inputs should be used when measuring a current loop which cannot be connected to earth or ground. This allows the input to be connected anywhere in the current loop. Common mode voltage can be up to 27VDC.

Up to four loops can be connected, to terminal pairs [AIN1-AIN2], [AIN3-AIN4], [AIN5-AIN6], [AIN7-AIN8] - the former terminal is +ve and the latter –ve.
The diagram in Figure 2-8 indicates how to connect devices for differential mode current inputs.

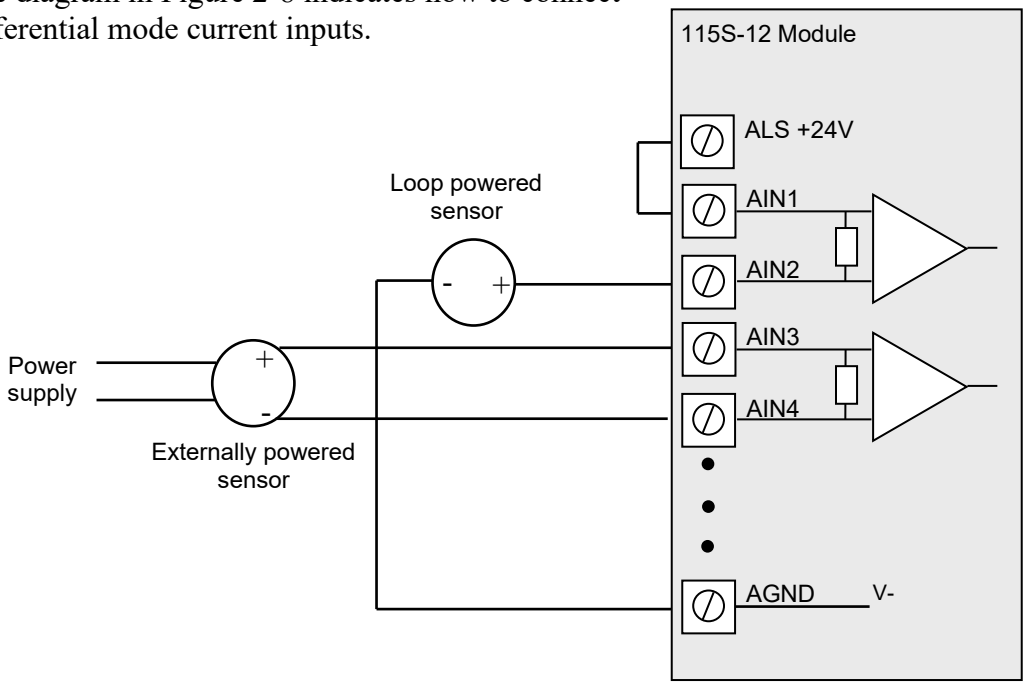

Figure 2-8: Connections for differential current inputs.

Note:

- The module configuration needs to be changed for this type of input
- To change the input configuration, refer to section 4.4

WARNING !

Ensure correct DIP switch positions AND software configuration has been completed for each analogue input BEFORE connecting external signals to the 115S-12 module.

2.2.3.3 Floating Differential Voltage Inputs

Differential voltage inputs allow a voltage to be measured when it cannot be referenced to earth or ground. The diagram in Figure 2-9 shows how to connect differential voltage inputs. The module has a 27V common mode input range.

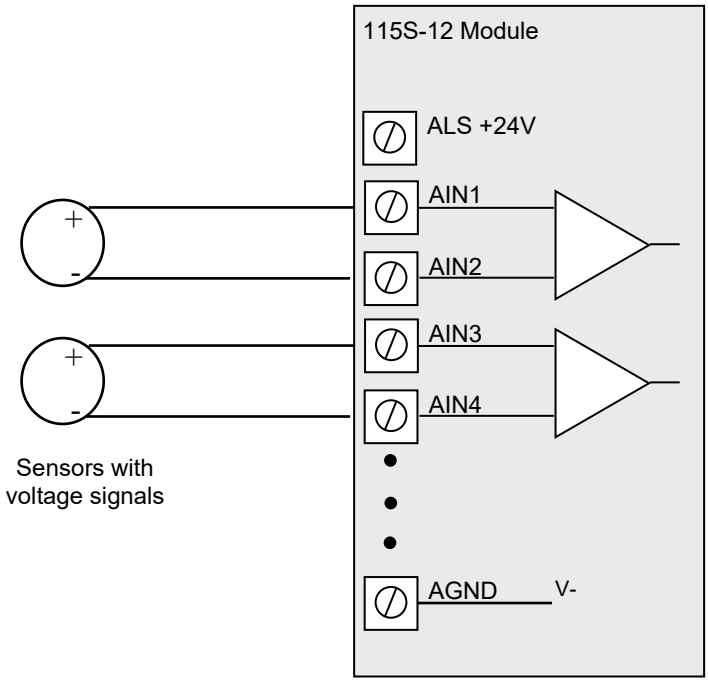

Figure 2-9: Connection for differential voltage input mode.

Note:

- The module configuration needs to be changed for this type of input
- To change the input configuration, refer to section 4.4

WARNING !

Ensure correct DIP switch positions AND software configuration has been completed for each analogue input BEFORE connecting external signals to the 115S-12 module.

2.2.3.4 Single-ended Voltage Input

Single-ended voltage inputs allow twice as many inputs as differential mode. This mode is useful when one end of the input voltage can be connected to the ground of the 115S module. Figure 2-10 shows connections for single-ended voltage input.

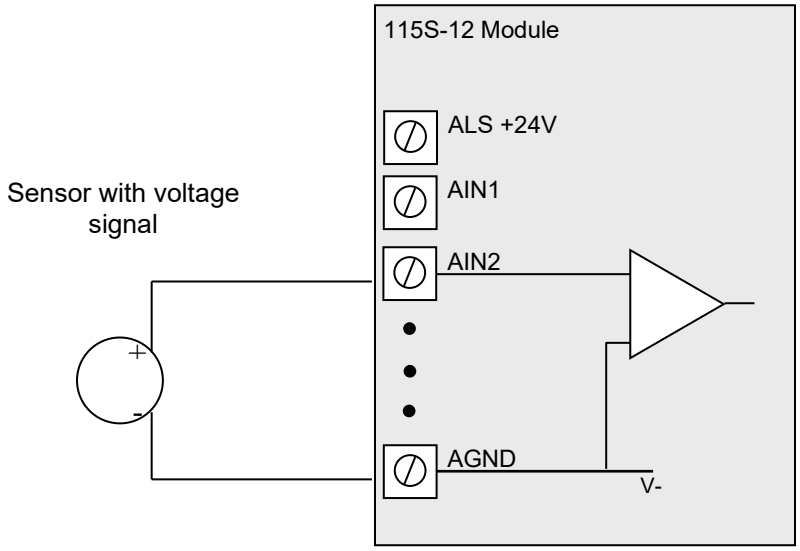

Figure 2-10: Connection for single-ended voltage input.

Note:

- The module configuration needs to be changed for this type of input
- To change the input configuration, refer to section 4.4

WARNING !

Ensure correct DIP switch positions AND software configuration has been completed for each analogue input BEFORE connecting external signals to the 115S-12 module.

2.2.4 Analog Outputs

The 115S-13 provides eight analog outputs. These may be configured as voltage or current outputs. The current output may be selected as “sink” or “source” current.

Refer to Section 4.5 for detail on configuring analog outputs.

2.2.4.1 Current Output

Current output mode may be configured for current source or current sink. Figure **2-11** shows the connections for current source mode. Figure 2-12 shows the connections for current sink.

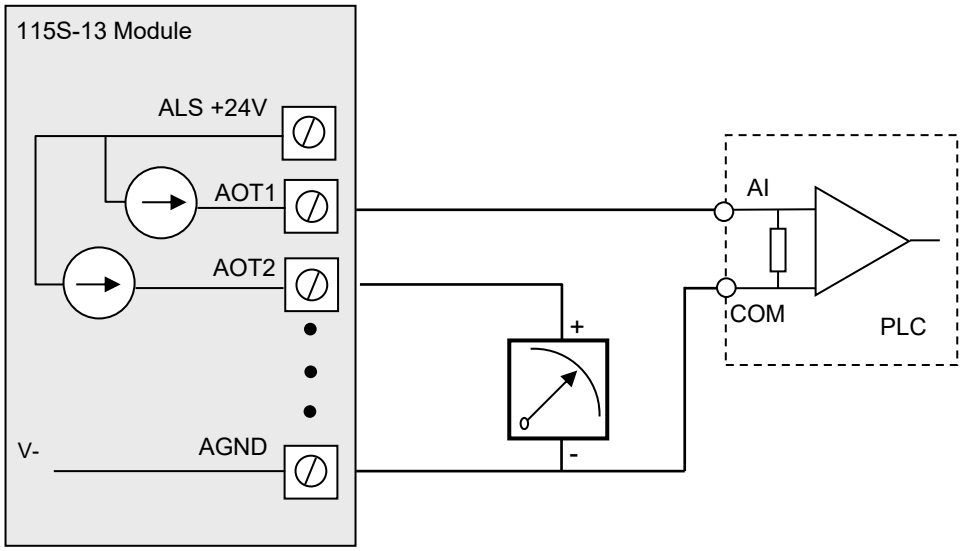

Figure 2-11: Connection for current source output.

Note:

- The module is configured at the factory for this type of output connection
- To change the input configuration, refer to section 4.5

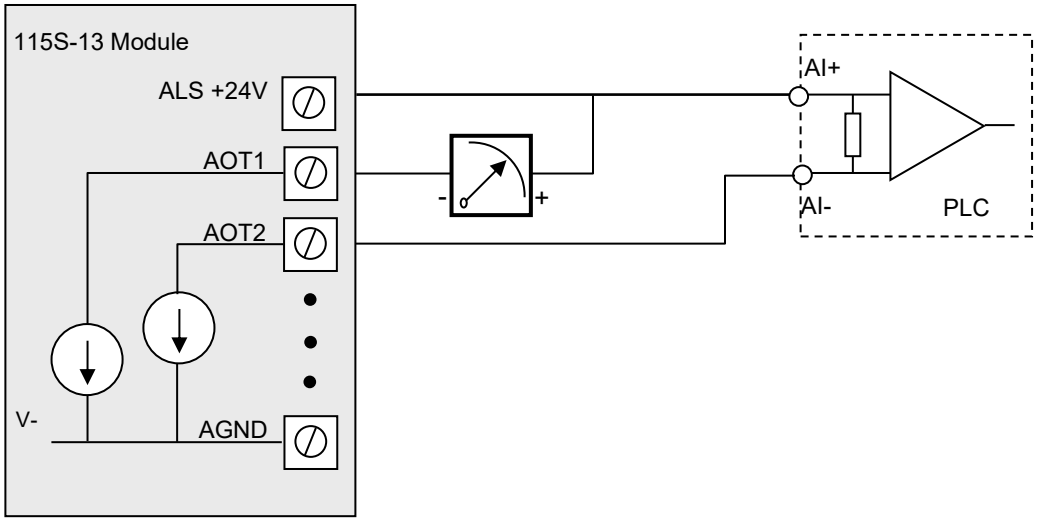

Figure 2-12: Connection for current sink output.

Note:

- The hardware configuration needs to be changed for this type of output connection
- To change the hardware configuration, refer to section 4.5

2.2.4.2 Voltage Output

Voltage output mode produces a voltage referenced to the module's AGND. Figure 2-13 shows the connection for voltage output configuration.

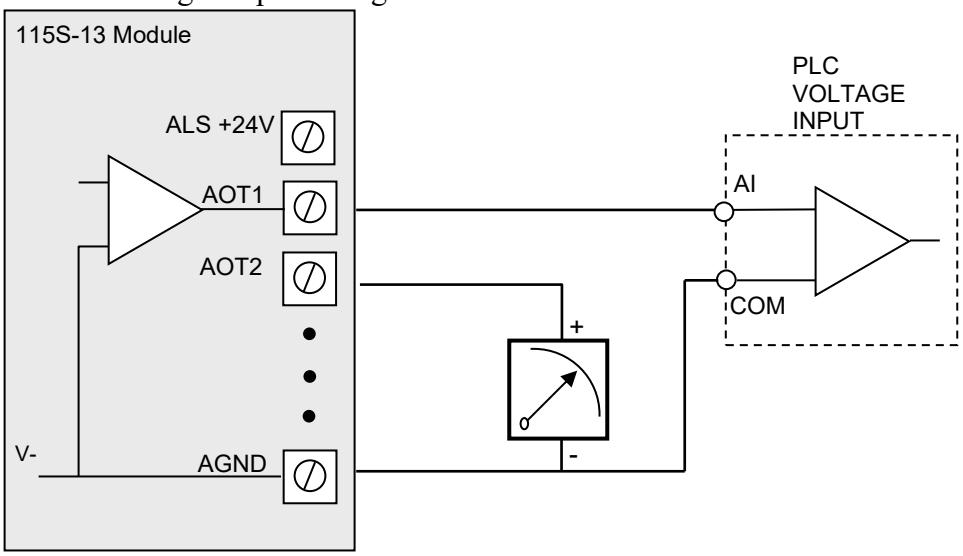

Figure 2-13: Connection for voltage output configuration.

3 Configuration

The 115S serial expansion modules can be configured as expansion I/O for the ELPRO Legacy radio modules. When configured like this the module communicates using standard ELPRO protocol which works on a Change of State concept like all other ELPRO radio modules and mappings must be asigned in each expansion module.

The module can also be configured as a Standard MODBUS Slave device with our Condor Radio Range or a Standa lone Modsbu Master. This then communicates by responding to poll messages from a MODBUS Master (Condor Radio, DCS, SCADA, PLC, Etc).

3.1 ELPRO Legacy Expansion I/O configuration.

Use the ELPRO Legcay Configuration utility to configure the 115S module to communicate to 105U and 905U radio modules.

- Ensure the Address switches are set to “00” for ELPRO protocol mode. Refer to section 2.1.2 for details on setting the address switches.

The ELPRO Configuration utility allows you to configure systems consisting of a mixture of ELPRO Module types.
The software can be downloaded from the ELPRO web-site, or from the ELPRO Product CD included with your device.

115S expansion I/O module can only be added to the software via the ‘Serial Units’ branch of a radio module, see Figure 3.1 below.

If using the module as a standalone serial device (without radios) you will need to add a dummy radio module to the software and then add all serial module to this dummy modules ‘Serial Units’ branch.

- Refer to your radio module user manual for an explanation on how to create the radio module configuration.

Once you have created the new radio module configuration, or a radio module was already present you can add a serial module. Select the radio module that you want to connect the 115S serial module to, and select the “Serial Units” item. Select “Add a new Serial Unit” to create the new configuration, or select “Load a New Serial Unit” to load the configuration from an existing module. See Figure 3-1 & 3.2 below.

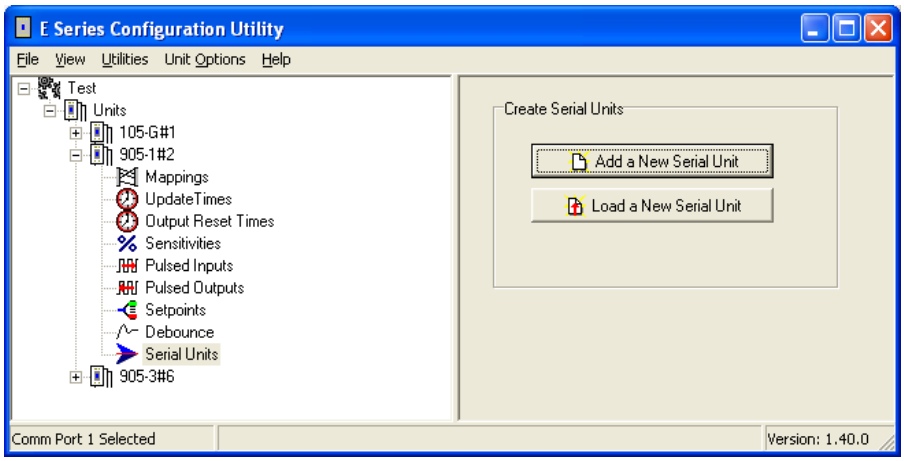

Figure 3-1: Configuration of 115S modules using ELPRO Configuration Utility.

When you select "Add a new Serial Unit" you will need to select the unit type. Select the correct module type here.

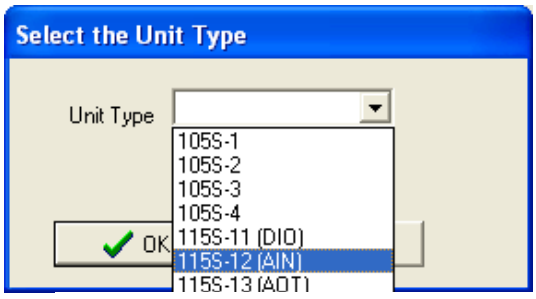

Figure 3-2: Select the unit type.

Finally, you will be prompted to select the module address. You can choose to allow the configuration software to select an unused address for you, or you can select the module address manually.

- Serial Module address must be in the range 96 to 127.
- Every serial module that is connected to the same radio module needs a separate address.
- You can use the same address on two different serial modules if they are connected to different radio modules.

Note – When using modules as Elpro Expansion I/O each module will be assigned 3 addresses.

Once you have added the new module you can configure I/O mappings the same way you would for the older 105 series modules or a radio module.

For more information on configuring ELPRO E-Series modules using the E-Config software, refer to the 105-1 or 905-1 user manual.

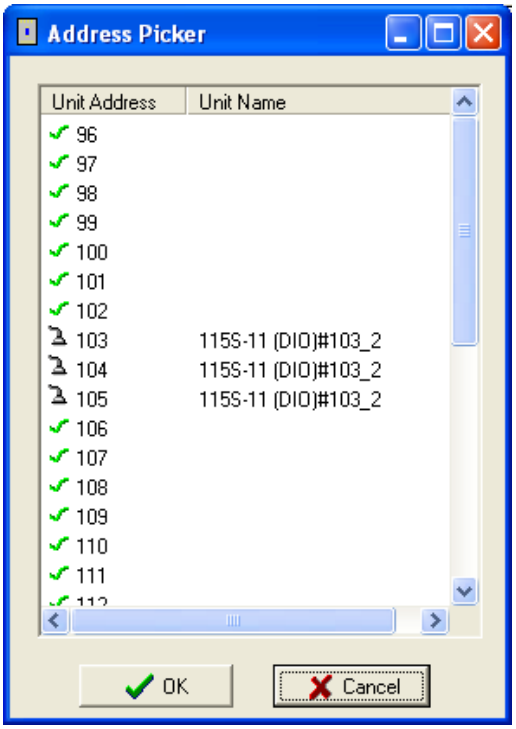

Figure 3-3: Select unit address.

3.2 ELPRO CONDOR Radio Expansion I/O Configuration

If configuring with Condor Radios the module will need to have a unique Slave address, see section 2.1.2 “Address Switches” above for details on how this is done.

The Rotary Address will be the address that the Condor Radio uses to offset the I/O values in the I/O store locally.
The Condor Radio will automatically add the I/O from the 115S modules to the internal I/O store. To calculate the register location in the I/O store, find the address of the I/O point in the tables in Appendix A at the end of this manual, and then add the offset. The offset is the Rotary Address (Modbus address), multiplied by 20.

These register are continually polled by the Condor Radio and then stored locally in the radio to be forwarded to other radios in the system via normal Elpro communications protocols.
Example Local radio address based on Expansion I/O address:

- Digital input #1 on an 115S-11 with address 1 would be: (1x20) +10001 = 10021
- Digital output #2 on an 115S-11 with address 6 would be: (6x20) +2 = 122
- Analog input #3 on an 115S-12 with address 2 would be: (2x20) +30003 = 30043.
- Analog output #8 on an 115S-13 with address # 1 would be:(1x20)+40027=40147

3.3 STAND ALONE MODBUS Slave

The MODBUS Master device can poll the I/O using standard Read/Write commands from the device.
The Address selected will be the address that the MODBUS Master needs to poll to gather data. When the Modbus Master Polls the Slave is does so using a Modbus Command and an I/O location. This Modbus command will varies depending on whether they are Inputs / Outputs and Analog / Digital values.
Example - See Appendix A “Modbus address map” for the I/O registers locations.

- To read a Digital Input on the module an “02: Input Status” command is used and the Modbus address will be in the range 10001 – 19999

- To read an Analog input on the module an “04: Input Register” Command is used and the Modbus address will be in the range 30001 – 39999.

- To write to a Digital output (Turn it on) you need to use a “01: Coil Status” Command and the Modbus address location will be 0001 – 9999

- To Write to an Analog output you will need to use an “03: Holding Register” command and the Modbus Address will be in the range 40001 – 49999

Note: all Analog values are 16 bit unsigned integers.
We recommend using Wintech’s Modscan and Modsim which is a low cost Modbus Master and Modbus Slave simulators that can help diagnose any Read/Write addressing issues. www.win-tech.com

4 Hardware Configuration

Hardware Set-up allows the 115S hardware function to be adjusted to suit the application. To configure the hardware settings, you need:

- Access to the DIP switches under the Analog Configuration Panel (refer Figure 2-1: 115S unit with significant parts labeled.)
- Configuration Software to run on your PC.

Hardware configuration of the 115S modules is performed by either the dedicated 115S configuration software (cfg_115S_Vx.xx.exe), or by the ELPRO configuration software, either E-Series, Mconfig or Cconfig (from the Utilities menu). The software is available from ELPRO's resource web page

4.1 Connecting to the 115S module

To use the configuration software, perform the following steps:

- Connect the 115S to the PC COM port with a standard serial cable (straight-through, DB9 female to DB9 male. See Appendix for wiring.)
- Set the address switches to 00
- Supply power to the 115S via the "+" and "-" terminals on the bottom of the module (10.8-30 VDC **).

  ***** Model Dependent. Check rear label for actual operating voltages***

- Start the configuration software on your PC or laptop (cfg_115S_Vx.xx.exe)

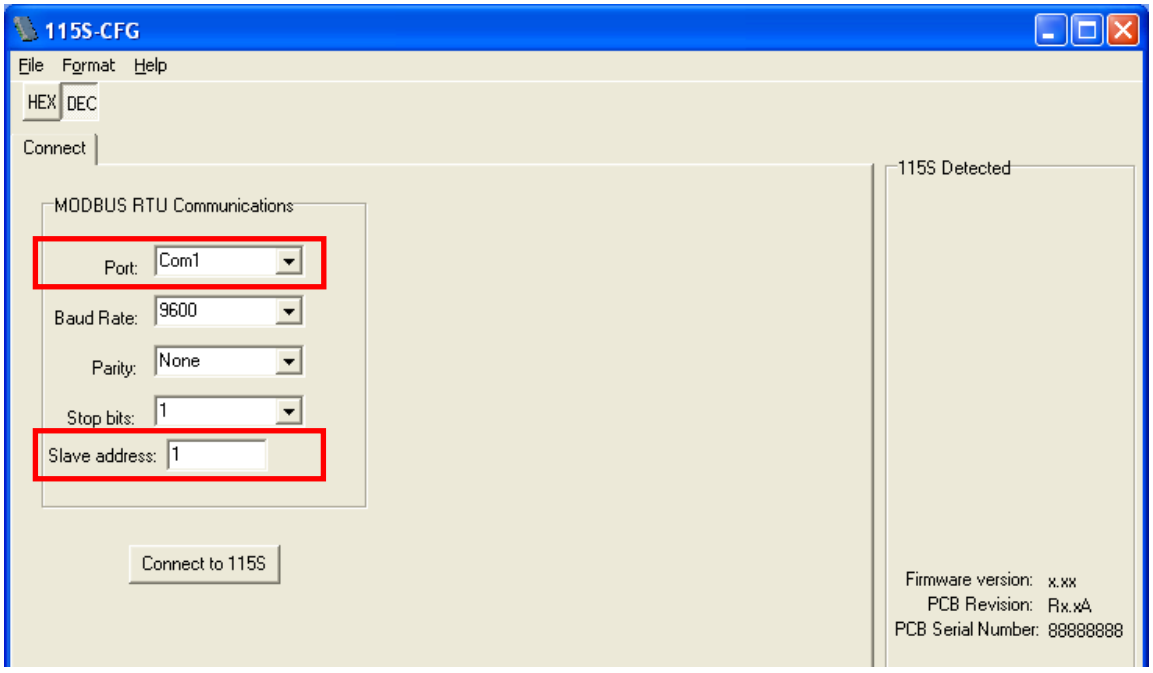

Figure 4-1: Main configuration screen.

- Set the "Port" setting to match the computer com port you have connected to.
- Set the "Slave Address" to match the address switch setting of the 115S. If you are using address "00" for ELPRO Protocol, set the Slave Address to 100.
- Set the communications parameters. The default communications parameters are:

  Baud rate: 9600
  Parity: NONE
  Stop bits: 1

Click the button labelled *Connect to 115S*.

If you are unable to communicate with the 115S, refer to Appendix C: Comms Recovery.

If connection has been successful, several folder tabs will become available, depending on the module type. The panel on the right-hand side of the form shows the 115S detected and its settings.

4.2 Configuration common to all modules

4.2.1 Communications

Select the *Comms* folder tab. This page allows you to change the communications settings of the 115S.

These settings are applied to both the RS-232 configuration port and to the RS-485 Modbus interface port.

Choose the required settings, then click *Set comms*. You will need to power off / on the 115S for the new settings to take effect.

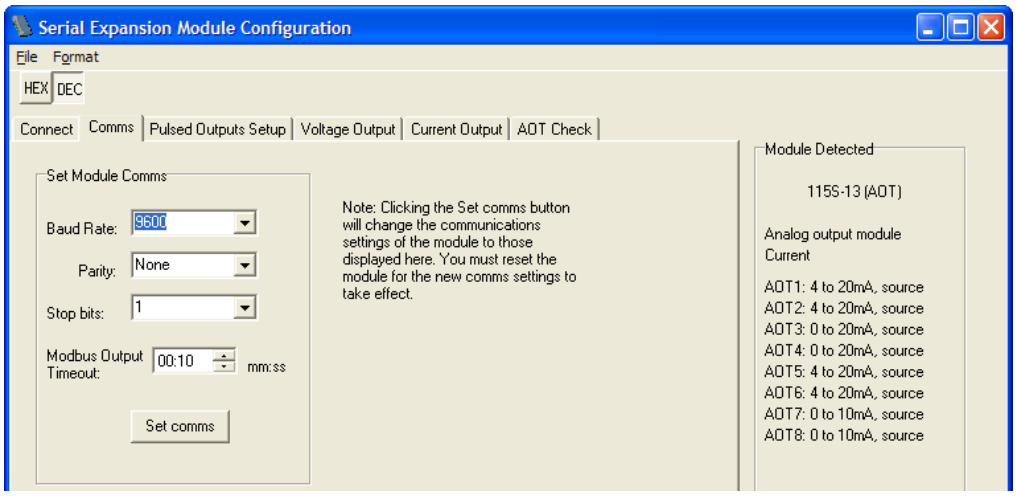

Figure 4-2: Communications configuration screen.

4.2.2 Modbus Output Timeout on Comms fail

The module when being used as a Modbus Slave device has an output reset on comms fail feature.
This means the outputs are turned off after a configured timeout if the module doesn't receive any Modbus polls to itself.

Note: The Modbus Output Timeout feature is available in Firmware version 2.02 and above.

To set the Modbus Output reset time use the configuration software (V1.09 and above) and under the "Comms" tab you will see a "Modbus Output Timeout". Select the appropriate time and then press the "Set Comms" button and then resetting the module. See Figure 4-2 above

Note that you will need to change the connection settings on the "Connect" page, and re-connect to the 115S.

Maximum Output timeout is 34 minute 57 seconds.

Selecting 00:00 minutes and seconds will disable the outputs resetting.

Be aware the "Modbus Output Timeout" must be greater than the Modbus Master Poll time or you will see the outputs reset before the next poll. Generally it is good practice to configure the reset time to two or three times the Modbus poll time so as to ensure accurate comms fail indication.

The "Modbus Output Timeout" can also be configured by the Modbus Master by writing into register 204 in units of 32 msec.

> E.g. A0 hex would be 5.12 seconds, 3A9 hex would be 30 seconds, and 249F would be 5 minutes.

The module then needs to be reset for the settings to take effect.

Also the module must be operating in MODBUS mode, otherwise the reset outputs feature is disabled, so the modules address must be set to something other than "00".

If using the modules in ELPRO E-Series mode the Outputs also have a reset feature that can be configured within the E-Series Configuration Utility.

4.2.3 Configurable ACK Timeout

All communications between Elpro devices using Elpro Protocol is two way communications. The initiating module sends a message to an end device and expects to get a response within a given time period, this response is called an acknowledgement.
If this acknowledgment is not received in the allotted timeframe the message is retried up to 4 times with a random 0-5 seconds delay between each retry. If all retries are not acknowledged then a communications fail can be flagged.

Typically the 115S expansion I/O modules are used with 105U/905U I/O radios and the longer Acknowledge Timeouts are not required.
If using the modules with Elpro modems or third party devices were the acknowledgement is likely to take longer than 5 seconds then a configurable Ack time can be implemented to overcome these timing issues. E.g. Communication path may have a number of repeaters or be going through a network with longer timeframes (GSM or Ethernet Networks)

Note: The Configurable Acknowledge timeout is only available in firmware version 2.04 and greater.

The configurable Ack timeout allows the wait time of this response to be extended by adjusting a register shown in the table below.

Address	Description
40205	Configurable Ack timeout

The Ack timeout is configurable from 32msec to 34 minutes 57 seconds, see examples below. Ack Timeout will be added to the default random 0-5 sec retry time.

The factory value for the Ack timeout will be 0 which will use the default 0-5 second staggered timeout.

Decimal Value	Timeout	Decimal Value	Timeout
1	32msec	1875	1 Min
16	500msec	3750	2 Min
31	1 Sec	7500	4 Min
62	2 Sec	9375	5 min
100	3.2 sec	18750	10 Min
156	5 Sec	28125	15 Min
312	10 Sec	37500	20 Min
469	15 Sec	46875	25 Min
625	20 Sec	56250	30 Min
1000	32 Sec	65535	34 Min 57 Sec

4.2.4 Pulsed outputs

Choose the folder tab labeled *Pulsed Outputs Setup*, as shown in Figure 4-3.

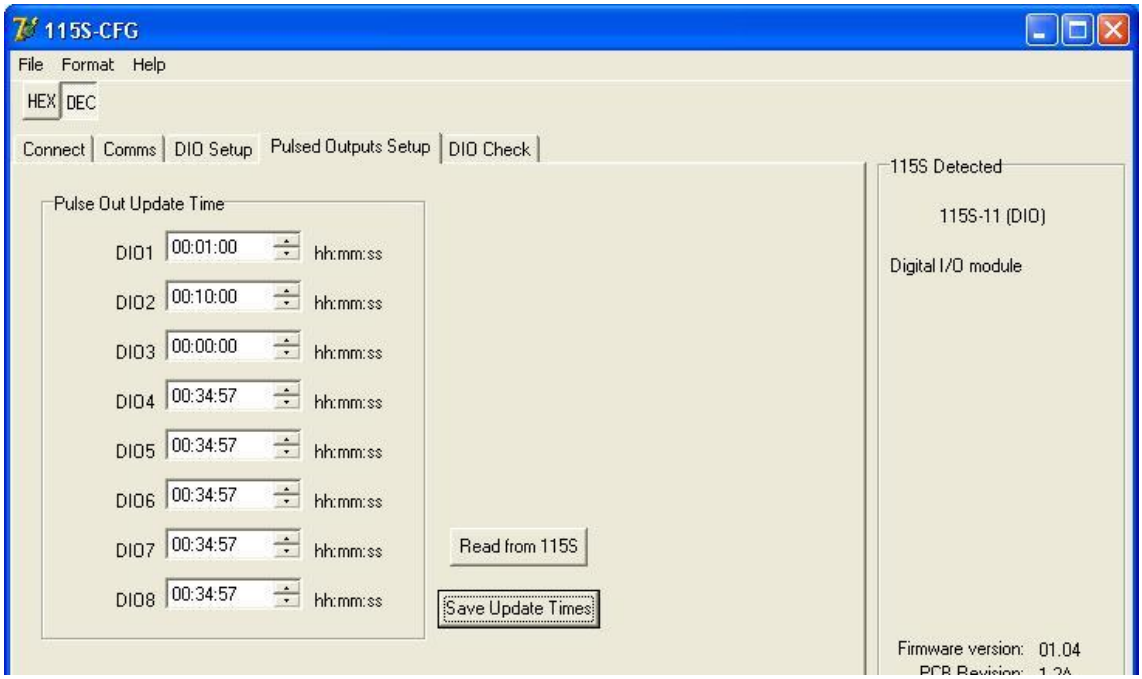

Figure 4-3: Pulsed outputs setup page for a 115S-11. The pulsed outputs are available on all models.

Clicking the button *Read from 115S* will read the pulse out update times from the 115S and display them on the form.

The Pulse Out Update Times should be set to the approximate interval at which the 115S will receive updates to its pulse out target register. The pulse output circuitry will attempt to generate pulses at a rate that will reach the target pulse count within the update time. For example, if the Modbus master unit is configured to send the register value for the pulse output channel every 1 minute, then the Update Time should be set to 1 minute.

The maximum allowed pulse out update time is 34 minutes 57 seconds. Set the update times for each channel in hours, minutes, and seconds. An update time of zero will never produce any pulses.

After the update times have been set, click the *Save Update Times* button.

The pulse output feature can be tested on the C*heck* folder tab (refer section 5).

4.3 115S-11 configuration

4.3.1 Pulsed Inputs

Choose the *Pulse Inputs Setup* page, as shown in Figure 4-4.

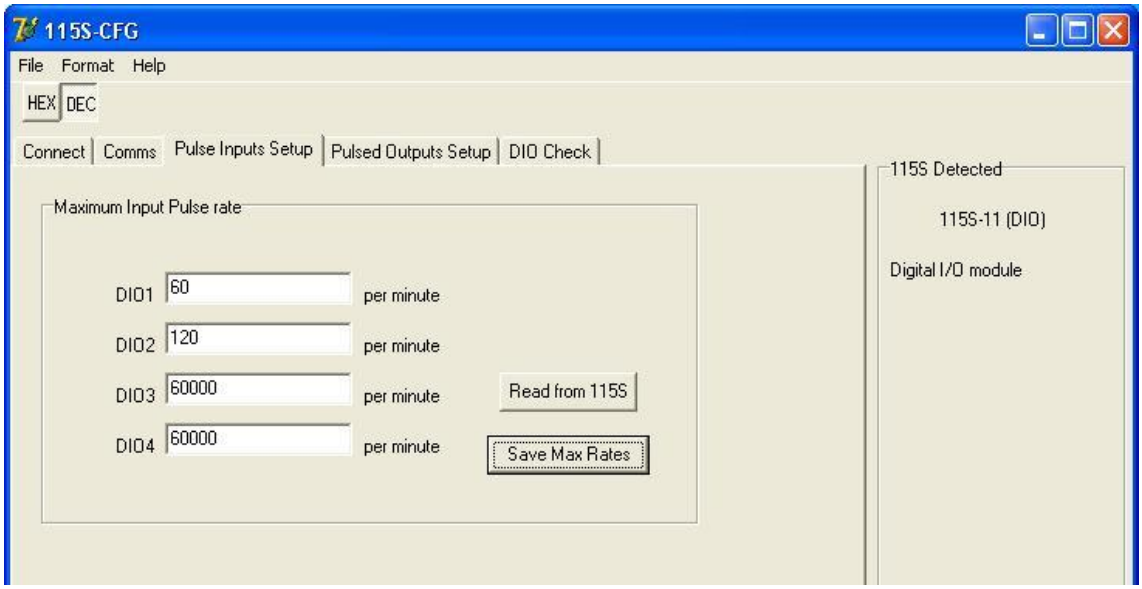

Figure 4-4: Pulse inputs setup. Only available on a 115S-11 module.

Clicking the *Read from 115S* button reads the existing maximum pulse rate settings from the 115S and displays them on the form.

If pulse rate is to be used, the maximum pulse input rate must be set. The pulse rate value is calculated as a fraction of the maximum pulse input rate. Specify the maximum pulse input rate in pulses per minute. The highest allowable pulse input rate is 60000 pulses per minute, or 1kHz.

Once the maximum pulse rates are specified, click the *Save Max Rates* button to save the data to the 115S module.

The pulse input feature can be tested on the *DIO Check* page (refer section 5.1).

4.4 115S-12 configuration

4.4.1 Voltage input

Voltage inputs may be selected in the scales 0 to 5V, 0 to 10V, or 1 to 5V. For each scale, the minimum to maximum signal levels are represented by 4000 hex to C000 hex. Table 4-1 shows how the 115S-12 voltage readings translate to outputs in other ELPRO products.

115S-12 Voltage scale	115S-12 Input voltage (V)	105-G Register value (hex)	105-1 Output current (mA)	105-3 Output current (mA)
0 to 5V	0	4000	4	4
	5	C000	20	20
0 to 10V	0	4000	4	4
	10	C000	20	20
1 to 5V	0	2000	0.5*	0
	1	4000	4	4
	5	C000	20	20

Table 4-1: Compatibility of 115S-12 voltage inputs with other ELPRO products. ***Reduced accuracy for less than 4mA in 105-1.**

4.4.1.1 Single-ended voltage input

If the 115S-12 is to measure voltage with respect to ground, choose the Single-ended voltage input page, as shown in Figure 4-5.

> Remove the access panel from the front of the 115S-12 case to gain access to the dip switches. Replace the access panel after setting the switches.

Set the switches according to the picture shown. The unit should be orientated with the 20-way connector towards you.

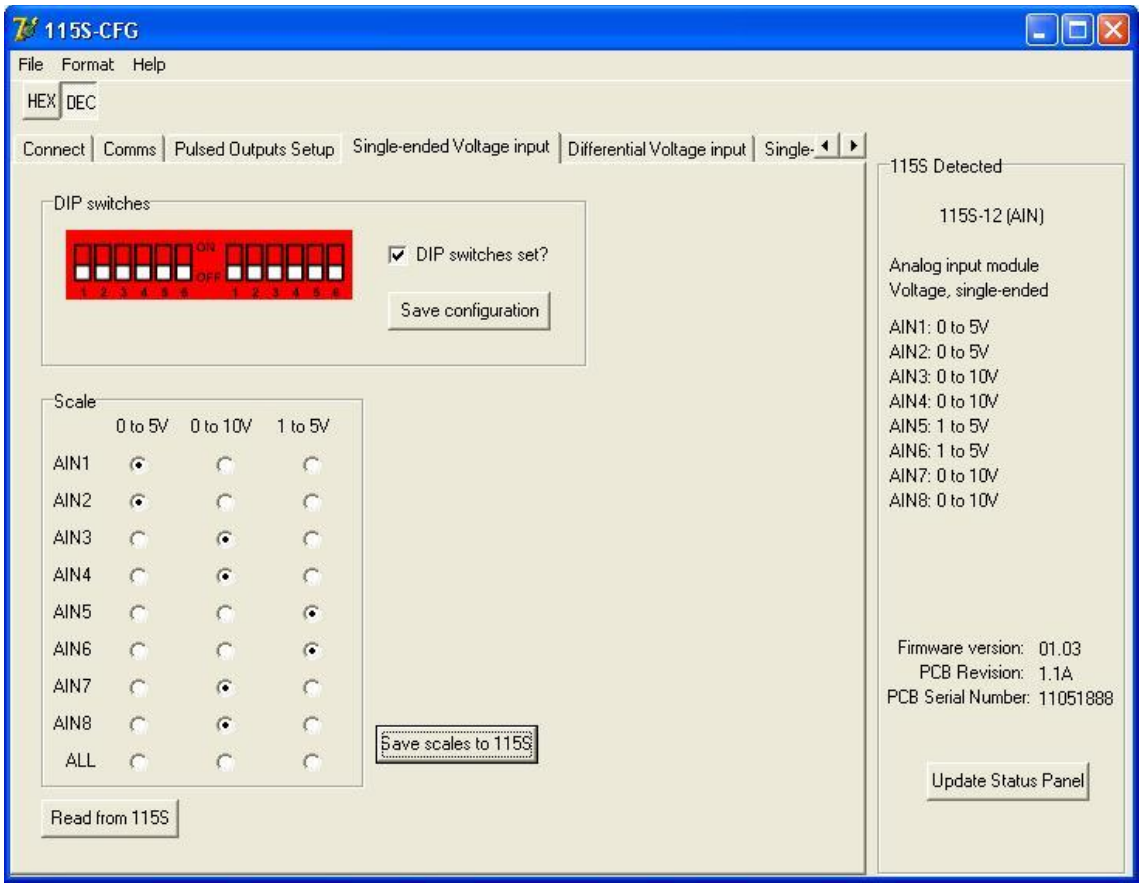

Figure 4-5: Setup page for single-ended voltage input.

Once the dip switches on the unit are set, tick the checkbox on the form, and click *Save configuration*. Check the *115S Detected* panel to ensure that the analog mode has been updated (to Voltage, single-ended).

Clicking *Read from 115S* will read the scales out of the unit (if any) and display them in the scales grid. Note that the dip switches should be set correctly for this result to be relevant.

Choose the desired scale for each channel in the *Scale* box. Click the *Save scales to 115S* button, and check that the scales are updated in the *115S Detected* panel.

4.4.1.2 Differential voltage input

The 115S-12 can be configured to measure differential voltage. Neighbouring channels serve as reference voltages in this mode. The four differential pairs are: AIN1-AIN2, AIN3-AIN4, AIN5-AIN6, and AIN7-AIN8.

Note: If mapping Differential Voltage inputs using the Elpro E-Series Configuration software only map the Odd inputs.
E.g. AIN1 for the first Differential input, AIN3 for the second, AIN5 for the third and AIN7 for the fourth.

If using Modbus all registers can be read but only the odd registers holds the values, i.e. 30001 for AIN1-AIN2, 30003 for AIN3-AIN4, 30005 for AIN5- AIN6 and 30007 for AIN7-AIN8.

Choose the page to configure the 115S-12 for differential voltage input, as shown in Figure 4-6.

> Remove the access panel from the front of the 115S-12 case to gain access to the dip switches. Replace the access panel after setting the switches.

Set the switches according to the picture shown. The unit should be orientated with the 20-way connector towards you.

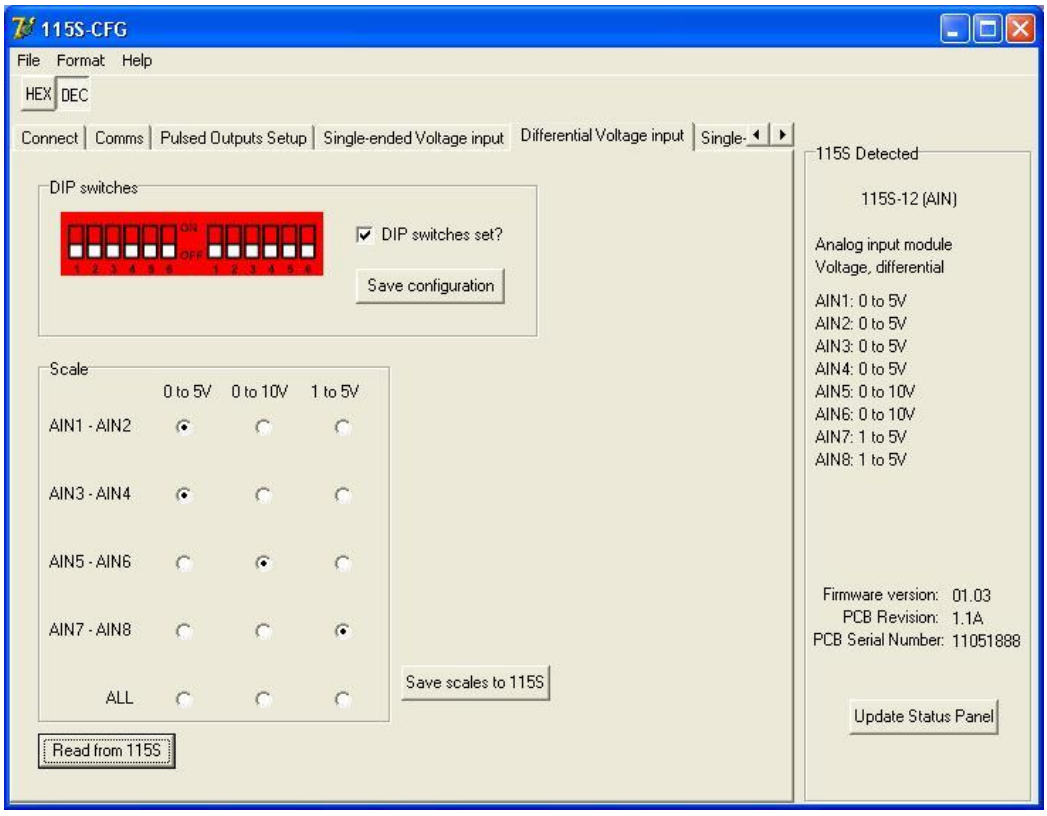

Figure 4-6: Setup page for differential voltage input.

Once the dip switches on the unit are set, tick the checkbox on the form, and click *Save configuration.* Check the *115S Detected* panel to ensure that the analog mode has been updated (to Voltage, differential).

Clicking *Read from 115S* will read the scales out of the unit (if any) and display them in the scales grid. Note that the dip switches should be set correctly for this result to be relevant.

Choose the desired scale for each channel in the *Scale* box. Click the *Save scales to 115S* button, and check that the scales are updated in the *115S Detected* panel.

4.4.2 Current input

Current inputs may be selected in the scales 0 to 10mA, 0 to 20mA, or 4 to 20mA. For each scale, the minimum to maximum signal levels are represented by 4000 hex to C000 hex. Table 4-2 shows how the 115S-12 current readings translate to outputs in other ELPRO products.

115S-12 Current scale	115S-12 Input current (mA)	105-G Register value (hex)	105-1 Output current (mA)	105-3 Output current (mA)
0 to 10mA	0 10	4000 C000	4 20	4 20
0 to 20mA	0 20	4000 C000	4 20	4 20
4 to 20mA	0 4 20	2000 4000 C000	0.5* 4 20	0 4 20

Table 4-2: Compatibility of 115S-12 current inputs with other ELPRO products. ***Reduced accuracy for less than 4mA in 105-1.**

4.4.2.1 Single-ended current input

The 115S-12 can also measure current input. To measure current with respect to ground, choose the Single-ended current input page, as shown in Figure 4-7.

> Remove the access panel from the front of the 115S-12 case to gain access to the dip switches. Replace the access panel after setting the switches.

Set the switches according to the picture shown. The unit should be orientated with the 20-way connector towards you.

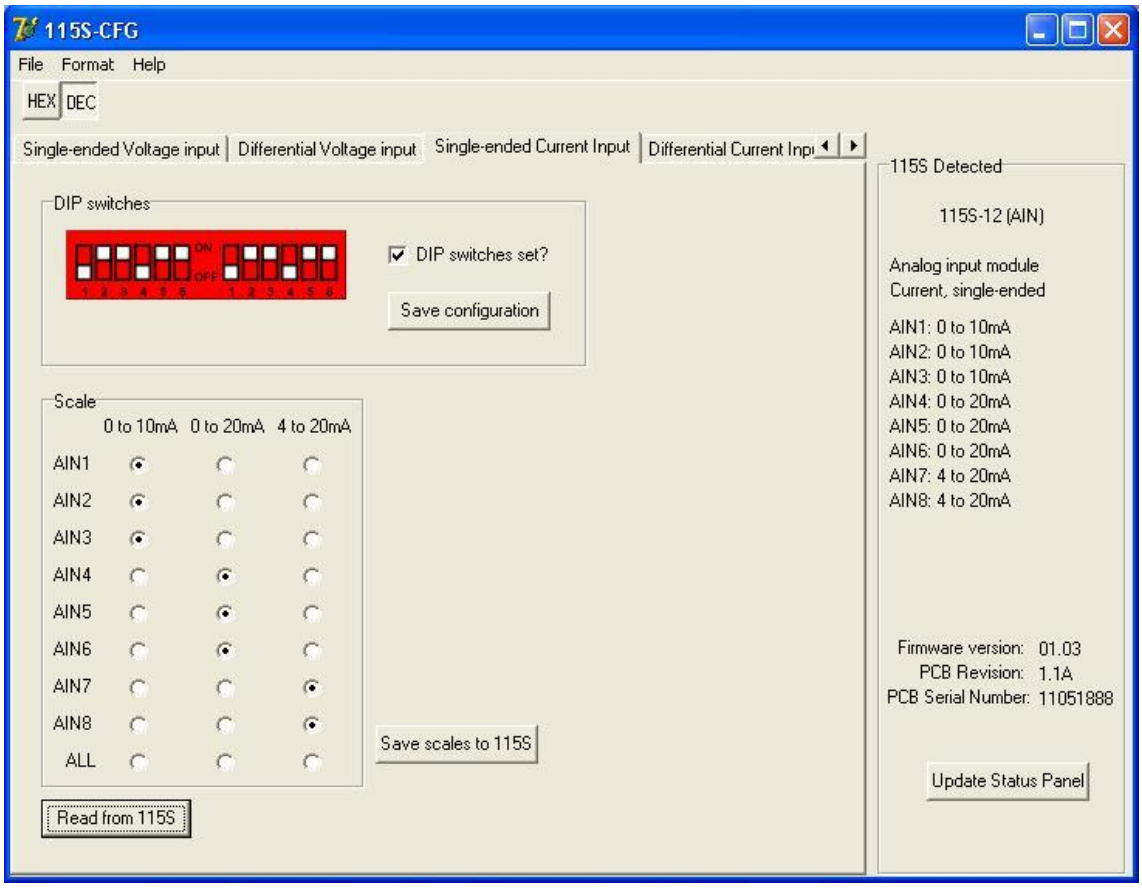

Figure 4-7: Setup page for single-ended current input.

Once the dip switches on the unit are set, tick the checkbox on the form, and click *Save configuration.* Check the *115S Detected* panel to ensure that the analog mode has been updated (to Current, single-ended).

Clicking *Read from 115S* will read the scales out of the unit (if any) and display them in the scales grid. Note that the dip switches should be set correctly for this result to be relevant.

Choose the desired scale for each channel in the *Scale* box. Click the *Save scales to 115S* button, and check that the scales are updated in the *115S Detected* panel.

4.4.2.2 Differential current input

The 115S-12 can be configured to measure differential current. The differential pairs are: AIN1-AIN2, AIN3-AIN4, AIN5-AIN6, and AIN7-AIN8. To use this configuration, choose the differential current input page, as shown in Figure 4-8.

Note: If mapping Differential Analog inputs using the Elpro E-Series Configuration software map only the Odd inputs.

E.g. AIN1 for the first Differential input, AIN3 for the second, AIN5 for the third and AIN7 for the fourth.

If using Modbus all registers can be read but only the odd registers holds the values, i.e. 30001 for AIN1-AIN2, 30003 for AIN3-AIN4, 30005 for AIN5- AIN6 and 30007 for AIN7-AIN8.

> Remove the access panel from the front of the 115S-12 case to gain access to the dip switches. Replace the access panel after setting the switches.

Set the switches according to the picture shown. The unit should be orientated with the 20-way connector towards you.

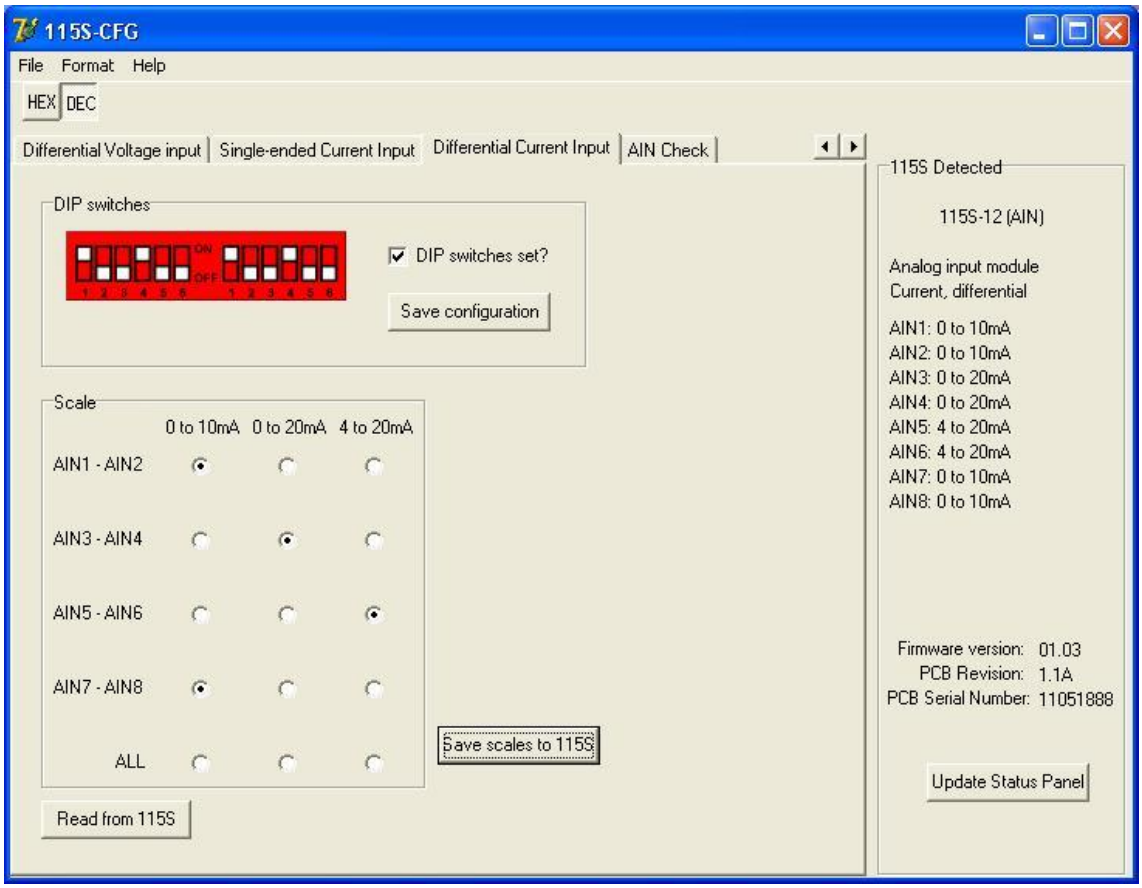

Figure 4-8: Setup page for differential current configuration.

Once the dip switches on the unit are set, tick the checkbox on the form, and click *Save configuration.* Check the *115S Detected* panel to ensure that the analog mode has been updated (to Current, differential).

Clicking *Read from 115S* will read the scales out of the unit (if any) and display them in the scales grid. Note that the dip switches should be set correctly for this result to be relevant.

Choose the desired scale for each channel in the *Scale* box. Click the *Save scales to 115S* button, and check that the scales are updated in the *115S Detected* panel.

4.5 115S-13 configuration

4.5.1 Voltage output

Voltage outputs may be selected in the scales 0 to 5V, 0 to 10V, or 1 to 5V. For each scale, the minimum to maximum signal levels are represented by 4000 hex to C000 hex. Table 4-3 shows how signals from other ELPRO products translate to 115S-13 voltage levels.

115S-13 Voltage scale	**105-1 Input current (mA)**	**105-2 Input current (mA)**	**105-G Register value (hex)**	**115S-13 Output voltage (V)**
0 to 5V	4	4	4000	0
	20	20	C000	5
0 to 10V	4	4	4000	0
	20	20	C000	10
1 to 5V	N/A*	0	2000	0
	2*	2	3000	0.5
	4	4	4000	1
	20	20	C000	5

Table 4-3: Compatibility of other ELPRO products with 115S-13 voltage outputs. ***Reduced accuracy for less than 4mA in 105-1.**

To configure the 115S-13 for voltage output, select the page as shown in Figure 4-9.

> Remove the access panel from the front of the 115S-12 case to gain access to the dip switches. Replace the access panel after setting the switches.

Set the switches according to the picture shown. The unit should be orientated with the 20-way connector towards you.

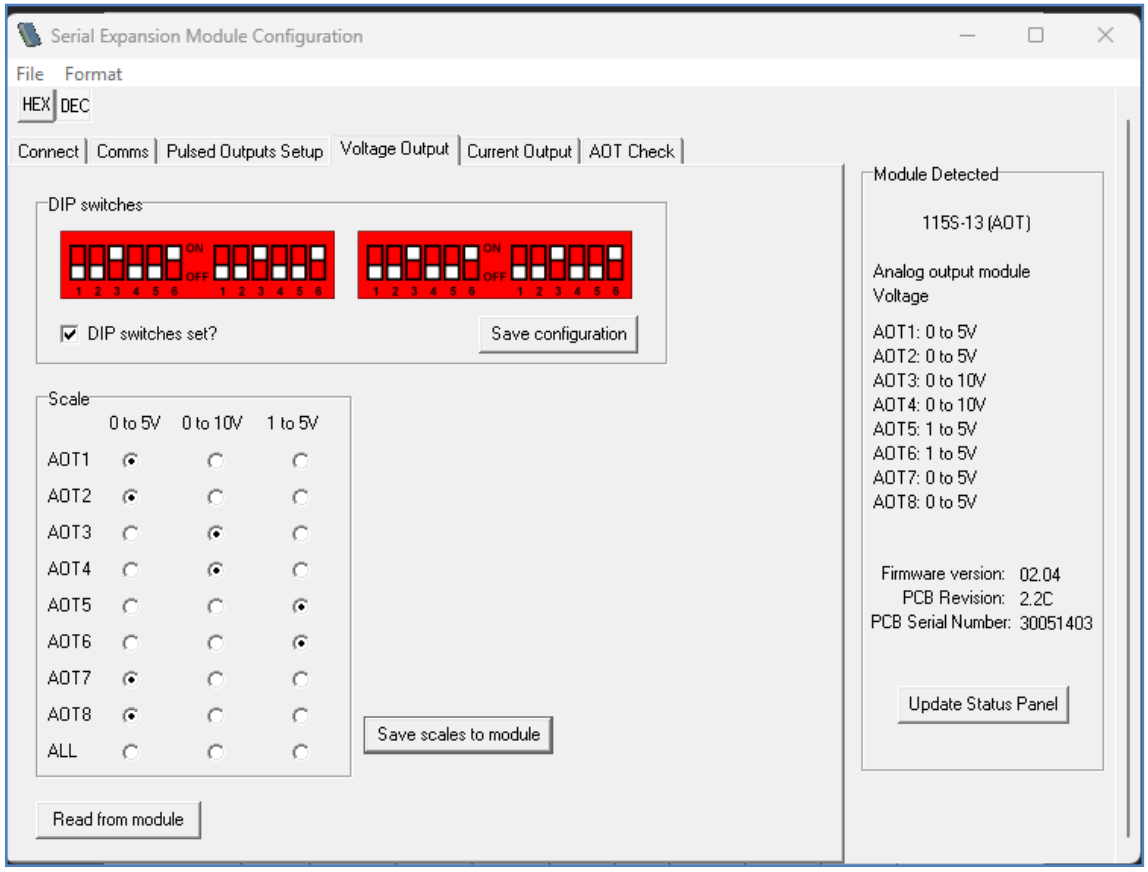

Figure 4-9: Voltage output setup page.

Once the dip switches on the unit are set, tick the checkbox on the form, and click *Save configuration.* Check the *115S Detected* panel to ensure that the analog mode has been updated (to Voltage).

Clicking *Read from 115S* will read the scales out of the unit (if any) and display them in the scales grid. Note that the dip switches should be set correctly for this result to be relevant.

Choose the desired scale for each channel in the *Scale* box. Click the *Save scales to 115S* button, and check that the scales are updated in the *115S Detected* panel.

4.5.2 Current output

Current outputs may be selected in the scales 0 to 10mA, 0 to 20mA, or 4 to 20mA. For each scale, the minimum to maximum signal levels are represented by 4000 hex to C000 hex. Table 4-4 shows how signals from other ELPRO products translate to 115S-13 current levels.

115S-13 Current scale	105-1 Input current (mA)	105-2 Input current (mA)	105-G Register value (hex)	115S-13 Output current (mA)
0 to 10mA	4	4	4000	0
	20	20	C000	10
0 to 20mA	4	4	4000	0
	20	20	C000	20
4 to 20mA	N/A*	0	2000	0
	2*	2	3000	2
	4	4	4000	4
	20	20	C000	20

Table 4-4: Compatibility of other ELPRO products with 115S-13 voltage outputs. ***Reduced accuracy for less than 4mA in 105-1.**

To configure the 115S-13 for current output, select the page as shown in Figure 4-10.

> Remove the access panel from the front of the 115S-12 case to gain access to the dip switches. Replace the access panel after setting the switches.

Set the switches according to the picture shown. The unit should be orientated with the 20-way connector towards you.

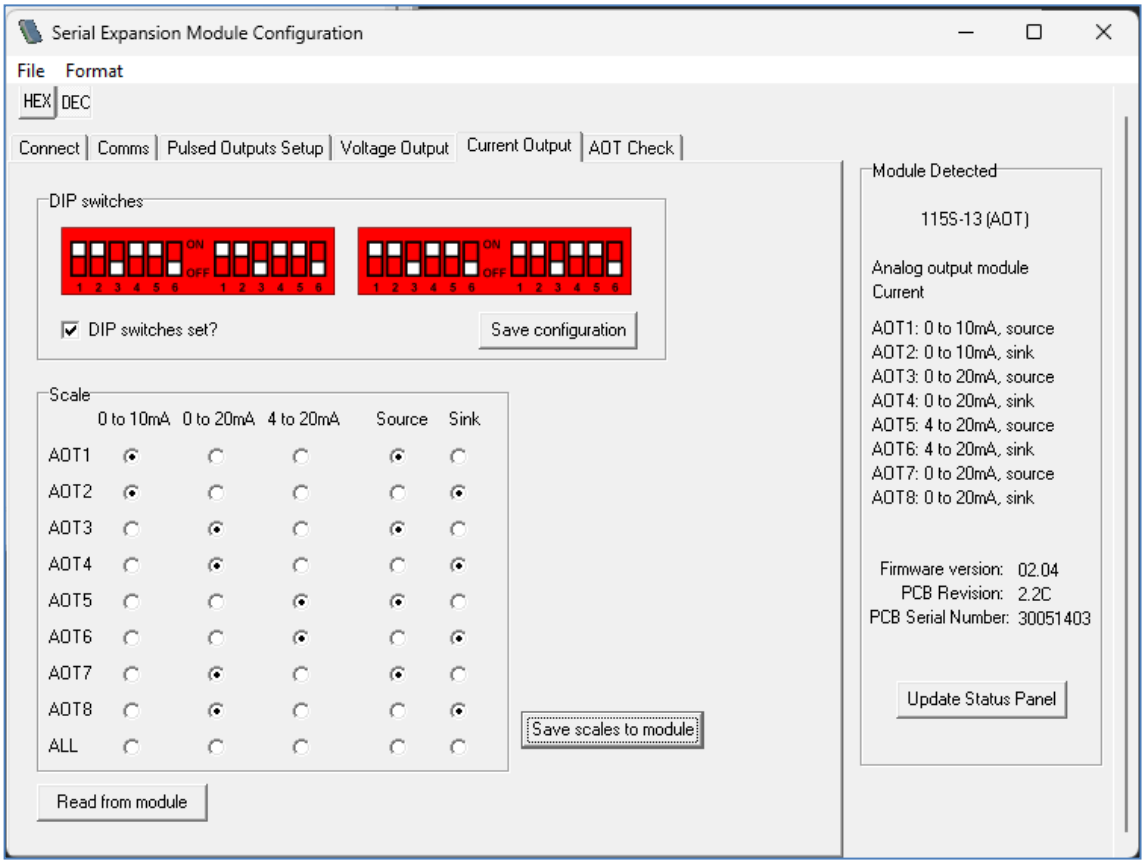

Figure 4-10: Current output setup page.

Once the dip switches on the unit are set, tick the checkbox on the form, and click *Save configuration.* Check the *115S Detected* panel to ensure that the analog mode has been updated (to Current).

Clicking *Read from 115S* will read the scales out of the unit (if any) and display them in the scales grid. Note that the dip switches should be set correctly for this result to be relevant.

Choose the desired scale for each channel in the *Scale* box. Click the *Save scales to 115S* button, and check that the scales are updated in the *115S Detected* panel.

5 Operation

5.1 115S-11 module

The I/O terminal block for the 115S-11 is shown in Figure 5-1.

Figure 5-1: I/O terminal block for 115S-11.

Pulse inputs coincide with DIO terminals 1-4. Pulse outputs coincide with DIO terminals 1-8.

The operation of the digital I/O may be confirmed using the configuration software. Start the software as described in section 4, and choose the *DIO Check* page as shown in Figure 5-2.

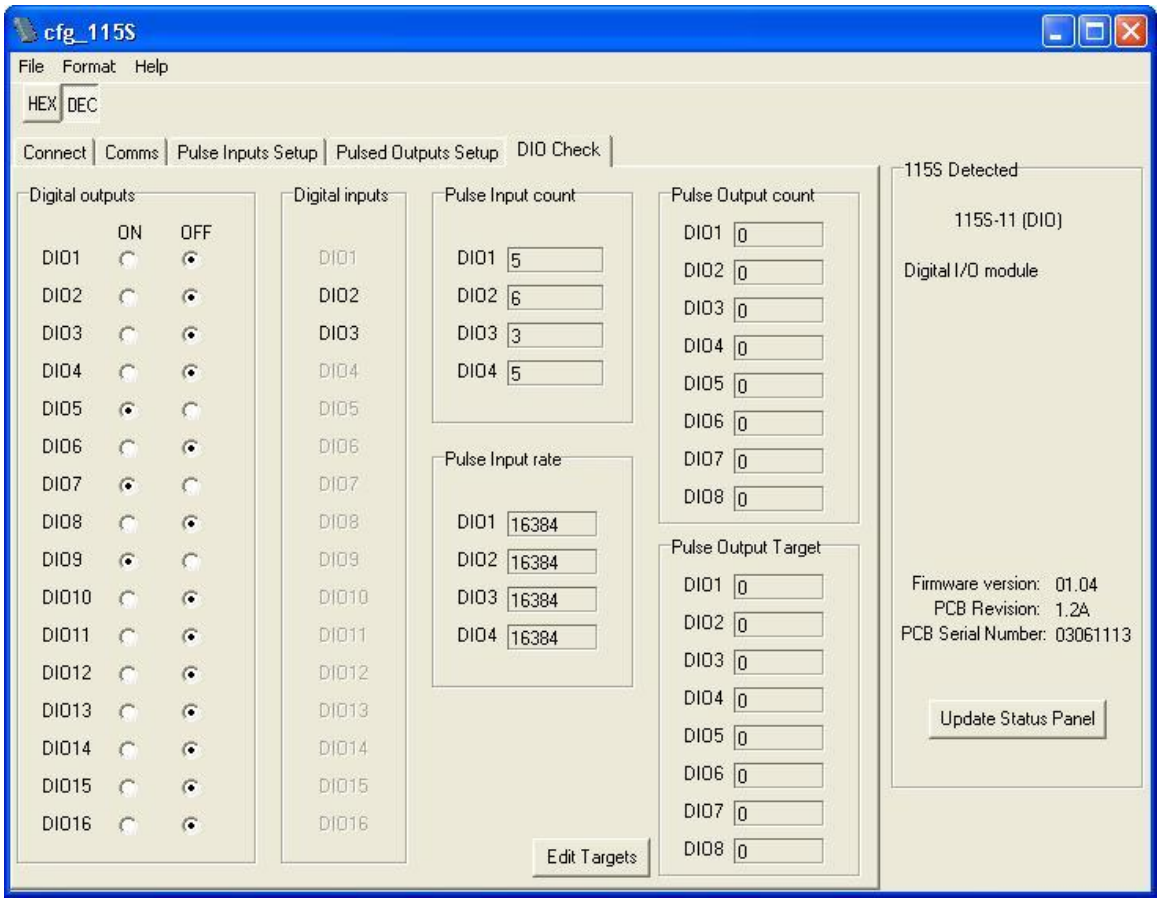

Figure 5-2: Check the operation of the 115S-11 module using the DIO Check page.

Test the digital outputs by setting the select-buttons to ON or OFF - this will force the DO to the selected state.

Digital inputs are reflected in the software by blacking (ON) or greying (OFF) of the associated label in the Digital Inputs column.

The pulsed input count values are shown, as well as the pulse rate. The rate can be viewed in decimal or hexadecimal and represents a fraction of the maximum pulse rate, where hex 4000 is 0% and hex C000 is 100% of the maximum pulse rate.

The pulse output count values are also shown. The pulse out target may be set by clicking the *Edit Targets* button. Pulses will be produced until the count reaches the target.

5.2 115S-12 module

The I/O terminal block for the 115S-12 is shown in Figure 5-3.

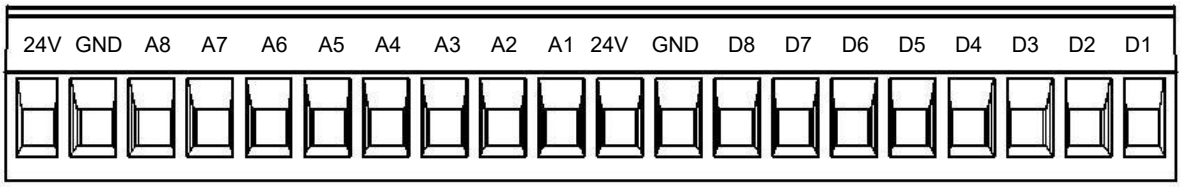

Figure 5-3: I/O terminal block for 115S-12.

Pulse outputs coincide with DIO terminals 1-8.

The operation of the 115S-12 may be confirmed using the configuration software. Start the software as described in section 4, and choose the *AIN Check* page as shown in Figure 5-4.

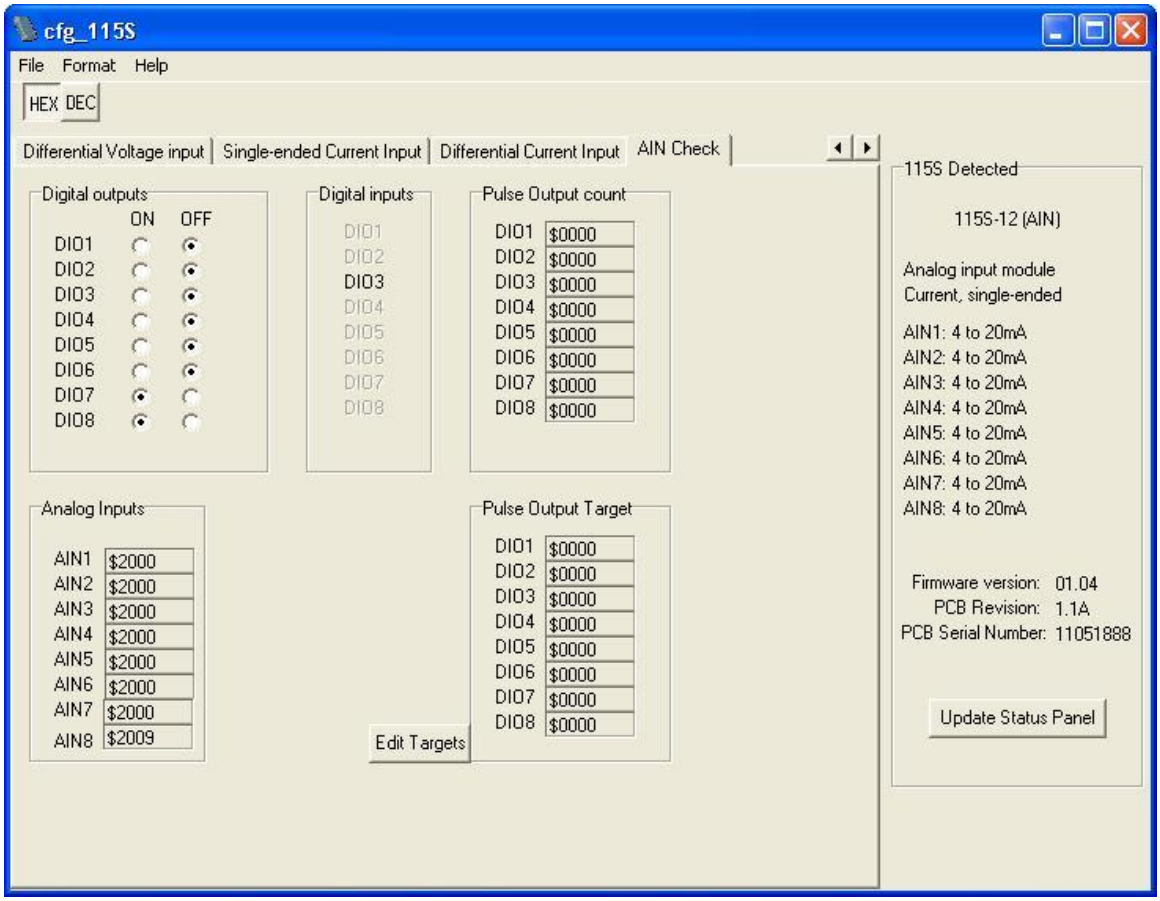

Figure 5-4: Check the operation of the 115S-12 module with the AIN Check page.

Test the digital outputs by setting the select-buttons to ON or OFF - this will force the DO to the selected state.

Digital inputs are reflected in the software by blacking (ON) or greying (OFF) of the associated label in the Digital Inputs column.

The pulse output count values are also shown. The pulse out target may be set by clicking the *Edit Targets* button. Pulses will be produced until the count reaches the target.

The analog inputs can be viewed in decimal or hexadecimal and represents a fraction of the analog signal, where hex 4000 is 0% and hex C000 is 100%.

In differential configuration, only the value of the first channel in the differential pair shows the quantity being measured. The second channel of each differential pair should be ignored.

5.3 115S-13 module

The I/O terminal block for the 115S-13 is shown in Figure 5-5.

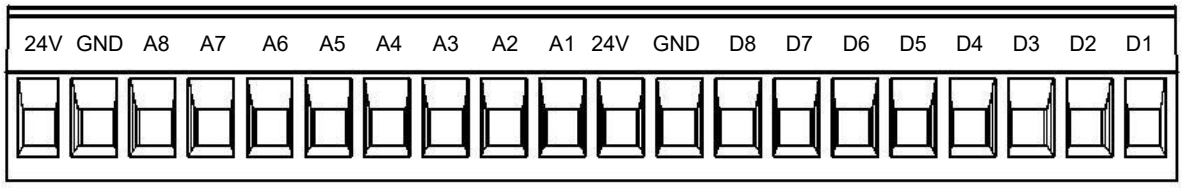

Figure 5-5: I/O terminal block for 115S-13.

Pulse outputs coincide with DIO terminals 1-8.

The operation of the 115S-13 may be confirmed using the configuration software. Start the software as described in chapter 4, and choose the *AOT Check* page.

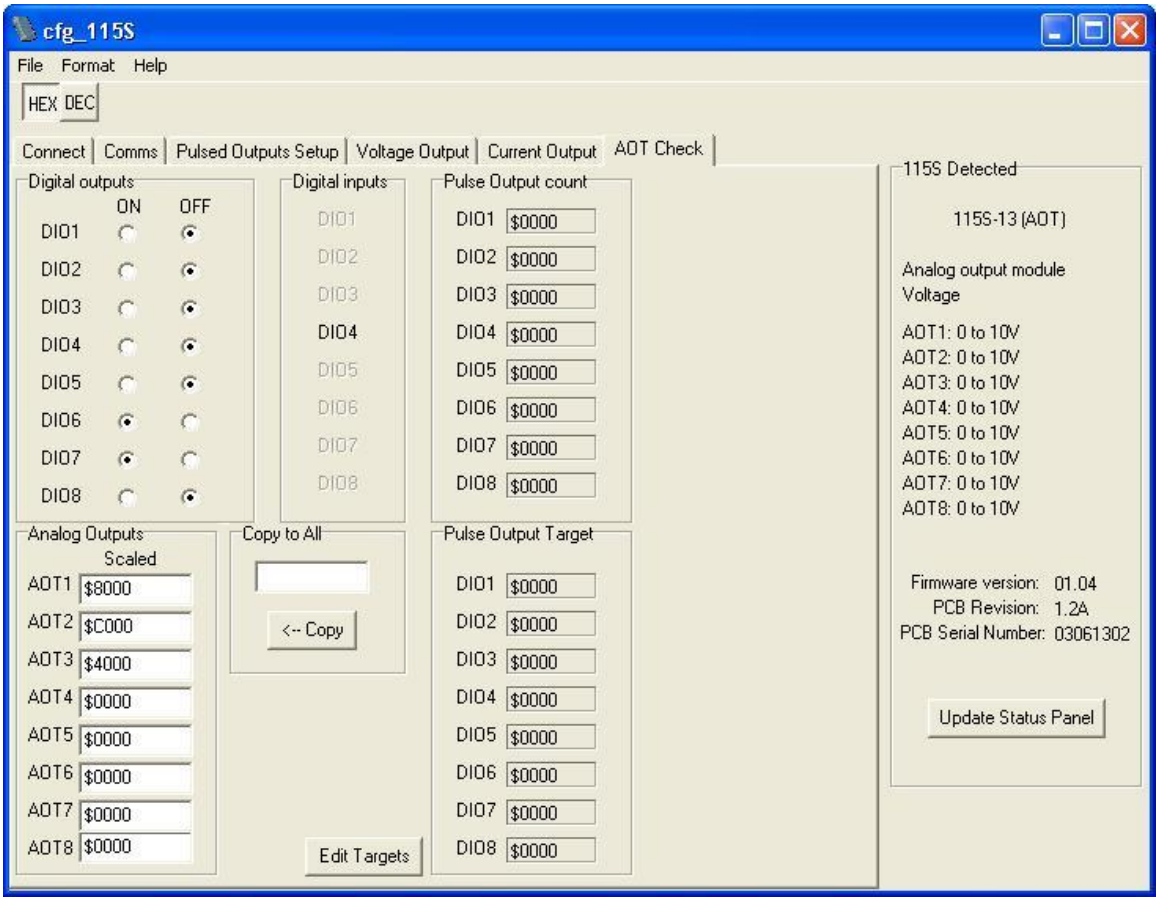

Figure 5-6: Check the operation of the 115S-13 module using the AOT Check page.

Test the digital outputs by setting the select-buttons to ON or OFF - this will force the DO to the selected state.

Digital inputs are reflected in the software by blacking (ON) or greying (OFF) of the associated label in the Digital Inputs column.

The pulse output count values are also shown. The pulse out target may be set by clicking the *Edit Targets* button. Pulses will be produced until the count reaches the target.

The analog outputs can be viewed in decimal or hexadecimal and represents a fraction of the analog signal, where hex 4000 is 0% and hex C000 is 100%.

The analog output values can be set by the user for testing, and the output signal measured to confirm the analog operation. If you are using hexadecimal values (which is the easiest) ensure the $ symbol precedes the value to denote a hex number.

5.4 Hexadecimal representation of voltage and current levels

The voltage and current levels are represented as a fraction of the configured scale. 4000 hex represents the minimum level in the scale, and C000 hex represents the maximum level in the scale.

Levels and their hex representation are summarised in Table 5-1 for easy reference.

			Voltage scale			Current scale		
Hex value	**Percent**	**Dec value**	**0-5V**	**0-10V**	**1-5V**	**0-10mA**	**0-20mA**	**4-20mA**
0000	0.00%	0	N/A	N/A	N/A	N/A	N/A	N/A
0800	3.13%	2048	N/A	N/A	N/A	N/A	N/A	N/A
1000	6.25%	4096	N/A	N/A	N/A	N/A	N/A	N/A
1800	9.38%	6144	N/A	N/A	N/A	N/A	N/A	N/A
2000	12.50%	8192	N/A	N/A	0.00	N/A	N/A	0.00
2800	15.63%	10240	N/A	N/A	0.25	N/A	N/A	1.00
3000	18.75%	12288	N/A	N/A	0.50	N/A	N/A	2.00
3800	21.88%	14336	N/A	N/A	0.75	N/A	N/A	3.00
4000	25.00%	16384	0.00	0.00	1.00	0.00	0.00	4.00
4800	28.13%	18432	0.31	0.63	1.25	0.63	1.25	5.00
5000	31.25%	20480	0.63	1.25	1.50	1.25	2.50	6.00
5800	34.38%	22528	0.94	1.88	1.75	1.88	3.75	7.00
6000	37.50%	24576	1.25	2.50	2.00	2.50	5.00	8.00
6800	40.63%	26624	1.56	3.13	2.25	3.13	6.25	9.00
7000	43.75%	28672	1.88	3.75	2.50	3.75	7.50	10.00
7800	46.88%	30720	2.19	4.38	2.75	4.38	8.75	11.00
8000	50.00%	32768	2.50	5.00	3.00	5.00	10.00	12.00
8800	53.13%	34816	2.81	5.63	3.25	5.63	11.25	13.00
9000	56.25%	36864	3.13	6.25	3.50	6.25	12.50	14.00
9800	59.38%	38912	3.44	6.88	3.75	6.88	13.75	15.00
A000	62.50%	40960	3.75	7.50	4.00	7.50	15.00	16.00
A800	65.63%	43008	4.06	8.13	4.25	8.13	16.25	17.00
B000	68.75%	45056	4.38	8.75	4.50	8.75	17.50	18.00
B800	71.88%	47104	4.69	9.38	4.75	9.38	18.75	19.00
C000	75.00%	49152	5.00	10.00	5.00	10.00	20.00	20.00
C800	78.13%	51200	5.31	10.63	5.25	10.63	21.25	21.00
D000	81.25%	53248	5.63	11.25	5.50	11.25	22.50	22.00
D800	84.38%	55296	5.94	11.88	5.75	11.88	23.75	23.00
E000	87.50%	57344	6.25	12.50	6.00	12.50	N/A	24.00
E800	90.63%	59392	6.56	13.13	6.25	13.13	N/A	N/A
F000	93.75%	61440	6.88	13.75	6.50	13.75	N/A	N/A

Table 5-1: Hex representation of voltage and current levels.

Appendix A. Modbus address map

A.1. 115S-11

Data	Modbus I/O Type	Modbus Addresses
Digital input 1	Input status	10001
Digital input 2	Input status	10002
Digital input 3	Input status	10003
Digital input 4	Input status	10004
Digital input 5	Input status	10005
Digital input 6	Input status	10006
Digital input 7	Input status	10007
Digital input 8	Input status	10008
Digital input 9	Input status	10009
Digital input 10	Input status	10010
Digital input 11	Input status	10011
Digital input 12	Input status	10012
Digital input 13	Input status	10013
Digital input 14	Input status	10014
Digital input 15	Input status	10015
Digital input 16	Input status	10016
Digital output 1	Coil status	00001
Digital output 2	Coil status	00002
Digital output 3	Coil status	00003
Digital output 4	Coil status	00004
Digital output 5	Coil status	00005
Digital output 6	Coil status	00006
Digital output 7	Coil status	00007
Digital output 8	Coil status	00008
Digital output 9	Coil status	00009
Digital output 10	Coil status	00010
Digital output 11	Coil status	00011
Digital output 12	Coil status	00012
Digital output 13	Coil status	00013
Digital output 14	Coil status	00014
Digital output 15	Coil status	00015
Digital output 16	Coil status	00016
Pulse input count 1	Input registers	30017 – 30018
Pulse input count 2	Input registers	30019 – 30020
Pulse input count 3	Input registers	30021 – 30022
Pulse input count 4	Input registers	30023 – 30024
Pulse input rate 1	Input registers	30001
Pulse input rate 2	Input registers	30002
Pulse input rate 3	Input registers	30003

Data	Modbus I/O Type	Modbus Addresses
Pulse input rate 4	Input registers	30004
Maximum input pulse rate 1	Input registers	30101
Maximum input pulse rate 2	Input registers	30102
Maximum input pulse rate 3	Input registers	30103
Maximum input pulse rate 4	Input registers	30104
Pulse output count 1	Input registers	30009
Pulse output count 2	Input registers	30010
Pulse output count 3	Input registers	30011
Pulse output count 4	Input registers	30012
Pulse output count 5	Input registers	30013
Pulse output count 6	Input registers	30014
Pulse output count 7	Input registers	30015
Pulse output count 8	Input registers	30016
Pulse output target 1	Holding registers	40009
Pulse output target 2	Holding registers	40010
Pulse output target 3	Holding registers	40011
Pulse output target 4	Holding registers	40012
Pulse output target 5	Holding registers	40013
Pulse output target 6	Holding registers	40014
Pulse output target 7	Holding registers	40015
Pulse output target 8	Holding registers	40016
Modbus Output Timeout	Holding registers	40204
Pulse out update time 1	Input registers	30109
Pulse out update time 2	Input registers	30110
Pulse out update time 3	Input registers	30111
Pulse out update time 4	Input registers	30112
Pulse out update time 5	Input registers	30113
Pulse out update time 6	Input registers	30114
Pulse out update time 7	Input registers	30115
Pulse out update time 8	Input registers	30116
Module supply voltage*	Input registers	30033
Serial port transmission mode	Input registers	30201
Serial port baud rate	Input registers	30202
Serial port parity and stop bit	Input registers	30203
Modbus Comms Fail Timeout!	Input registers	30204
ELPRO ACK Timeout!	Input registers	30205
Module Firmware version%	Input Register	30801

* 0x4000 = 8V; 0xC000 = 40V (Firmware earlier than 2.00 is 0x4000 = 8V; 0xC000 = 16V

! Timeout values in 32mSec increments

% 0x0204 = Ver 2.04

A.2. 115S-12

Data	Modbus I/O Type	Modbus Addresses
Digital input 1	Input status	10001
Digital input 2	Input status	10002
Digital input 3	Input status	10003
Digital input 4	Input status	10004
Digital input 5	Input status	10005
Digital input 6	Input status	10006
Digital input 7	Input status	10007
Digital input 8	Input status	10008
Digital output 1	Coil status	00001
Digital output 2	Coil status	00002
Digital output 3	Coil status	00003
Digital output 4	Coil status	00004
Digital output 5	Coil status	00005
Digital output 6	Coil status	00006
Digital output 7	Coil status	00007
Digital output 8	Coil status	00008
Pulse output count 1	Input registers	30009
Pulse output count 2	Input registers	30010
Pulse output count 3	Input registers	30011
Pulse output count 4	Input registers	30012
Pulse output count 5	Input registers	30013
Pulse output count 6	Input registers	30014
Pulse output count 7	Input registers	30015
Pulse output count 8	Input registers	30016
Pulse output target 1	Holding registers	40009
Pulse output target 2	Holding registers	40010
Pulse output target 3	Holding registers	40011
Pulse output target 4	Holding registers	40012
Pulse output target 5	Holding registers	40013
Pulse output target 6	Holding registers	40014
Pulse output target 7	Holding registers	40015
Pulse output target 8	Holding registers	40016
Modbus Output Timeout	Holding registers	40204
Pulse out update time 1	Input registers	30109
Pulse out update time 2	Input registers	30110
Pulse out update time 3	Input registers	30111
Pulse out update time 4	Input registers	30112
Pulse out update time 5	Input registers	30113
Pulse out update time 6	Input registers	30114
Pulse out update time 7	Input registers	30115
Pulse out update time 8	Input registers	30116

Data	Modbus I/O Type	Modbus Addresses
Analog inputs 1	Input registers	30001
Analog inputs 2	Input registers	30002
Analog inputs 3	Input registers	30003
Analog inputs 4	Input registers	30004
Analog inputs 5	Input registers	30005
Analog inputs 6	Input registers	30006
Analog inputs 7	Input registers	30007
Analog inputs 8	Input registers	30008
Module supply voltage*	Input registers	30033
Analog supply voltage (24V)+	Input registers	30034
Serial port transmission mode	Input registers	30201
Serial port baud rate	Input registers	30202
Serial port parity and stop bit	Input registers	30203
Modbus Comms Fail Timeout!	Input registers	30204
ELPRO ACK Timeout!	Input registers	30205
Module Firmware version%	Input Register	30801

* 0x4000 = 8V; 0xC000 = 40V (Firmware earlier than 2.00 is 0x4000 = 8V; 0xC000 = 16V

+ 0x4000 =12V; 0xC000 = 36V

! Timeout values in 32mSec increments

% 0x0204 = Ver 2.04

Note: If using Differential Voltage or Current inputs, only the odd inputs should be used, i.e. AIN1 for the first input, AIN3 for the second, AIN5 for the third and AIN7 for the fourth.

A.3. 115S-13

Data	Modbus I/O Type	Modbus Addresses
Digital input 1	Input status	10001
Digital input 2	Input status	10002
Digital input 3	Input status	10003
Digital input 4	Input status	10004
Digital input 5	Input status	10005
Digital input 6	Input status	10006
Digital input 7	Input status	10007
Digital input 8	Input status	10008
Digital output 1	Coil status	00001
Digital output 2	Coil status	00002
Digital output 3	Coil status	00003
Digital output 4	Coil status	00004
Digital output 5	Coil status	00005
Digital output 6	Coil status	00006
Digital output 7	Coil status	00007
Digital output 8	Coil status	00008
Pulse output count 1	Input registers	30009
Pulse output count 2	Input registers	30010
Pulse output count 3	Input registers	30011
Pulse output count 4	Input registers	30012
Pulse output count 5	Input registers	30013
Pulse output count 6	Input registers	30014
Pulse output count 7	Input registers	30015
Pulse output count 8	Input registers	30016
Pulse output target 1	Holding registers	40009
Pulse output target 2	Holding registers	40010
Pulse output target 3	Holding registers	40011
Pulse output target 4	Holding registers	40012
Pulse output target 5	Holding registers	40013
Pulse output target 6	Holding registers	40014
Pulse output target 7	Holding registers	40015
Pulse output target 8	Holding registers	40016
Modbus Output Timeout	Holding registers	40204
Pulse out update time 1	Input registers	30109
Pulse out update time 2	Input registers	30110
Pulse out update time 3	Input registers	30111
Pulse out update time 4	Input registers	30112
Pulse out update time 5	Input registers	30113
Pulse out update time 6	Input registers	30114
Pulse out update time 7	Input registers	30115
Pulse out update time 8	Input registers	30116
Analog outputs 1	Holding registers	40001

Data	Modbus I/O Type	Modbus Addresses
Analog outputs 2	Holding registers	40002
Analog outputs 3	Holding registers	40003
Analog outputs 4	Holding registers	40004
Analog outputs 5	Holding registers	40005
Analog outputs 6	Holding registers	40006
Analog outputs 7	Holding registers	40007
Analog outputs 8	Holding registers	40008
Module supply voltage*	Input registers	30033
Analog supply voltage (28V) +	Input registers	30034
Serial port transmission mode	Input registers	30201
Serial port baud rate	Input registers	30202
Serial port parity and stop bit	Input registers	30203
Modbus Comms Fail Timeout!	Input registers	30204
ELPRO ACK Timeout!	Input registers	30205
Module Firmware version%	Input Register	30801

* 0x4000 = 8V; 0xC000 = 40V (Firmware earlier than 2.00 is 0x4000 = 8V; 0xC000 = 16V

+ 0x4000 =12V; 0xC000 = 36V

! Timeout values in 32mSec increments

% 0x0204 = Ver 2.04

Appendix B. Modbus Functionality

Table B-1 specifies the maximum query and response data parameters for the 115S modules. See the Gould Modbus Protocol Reference guide (PI-MBUS 300 Rev B) for more detail.

Function code	Description	Maximum Data Size
1,2	Read coil / input status	1160 coils / inputs
3	Read holding (output) registers	145 registers
4	Read input registers	145 registers
5	Force single coil	1 coil
6	Set single register	1 register
7	Read exception status	8 coils
8	Loopback test	N/A
9,10	NOT SUPPORTED	NOT SUPPORTED
11	Communications event counter	N/A
12-14	NOT SUPPORTED	NOT SUPPORTED
15	Force multiple coils	1160 coils
16	Set multiple registers	145 registers
17-255	NOT SUPPORTED	NOT SUPPORTED

Table B-1: Supported Modbus functions and limitations for 115S modules.

Appendix C. Comms Recovery

If the communications setting of the 115S has been forgotten or mistakenly set, there is a way of recovering serial communications with the 115S. 115S firmware versions 1.04 and earlier require ModScan to do this. With later firmware versions, this can be done using the configuration software, cfg_115S_Vx.xx.exe.

Procedure for recovering communications with recent firmware (V1.05 and later):

1. Set the Modbus address switches to 00. This fixes the communications setting to Modbus RTU, 9600 baud, no parity, and one stop bit.
2. Connect a standard (straight-through) RS232 cable to the module and the PC.
3. Start the configuration software, cfg_115S_Vx.xx.exe.
4. Set the slave address to 100.
5. Ensure the comms settings are 9600 baud, no parity, one stop bit.
6. Click *Connect to 115S*
7. The module should connect successfully.
8. Choose the Comms page and change the settings to the desired parameters.
9. If the module did not connect successfully, try the steps listed below for using ModScan.

Procedure for recovering communications with firmware V1.04 and earlier:

1. Set the Modbus address switches to 00. This fixes the communications setting to those specified in step 6.
2. Connect the RS232 port to the PC and start ModScan.
3. Supply power to the 115S.
4. In ModScan, set the following
   - Address: 0201
   - Length: 3
   - Device ID: 100
   - Modbus Point Type: Holding register
5. Click Connection / Connect.
6. Choose the appropriate COM port. Also choose
   - Baud rate: 9600
   - Word length: 8
   - Parity: none
   - Stop bits: 1
7. Click Protocol Selection. Choose STANDARD ASCII for Transmission mode. Click OK, OK.
8. ModScan should connect to the module with no errors.
9. The registers displayed in ModScan represent the serial port settings that are used when the address switches are set to other than 00, as follows:

Address	Description
40201	Serial port transmission mode

40202	Serial port baud rate
40203	Serial port parity and stop bit

10. Use the tables below to work out the current communications settings, or write to the registers using ModScan to change the settings to the desired values. Note that the module transmission mode should be set to Modbus RTU.

    Modbus address 40201, serial port transmission mode:

Setting	**Register Value**
Modbus RTU	0x0101
Modbus ASCII, 8 data bits	0x0201
Modbus ASCII, 7 data bits	0x0202

    Modbus address 40202, serial port baud rate:

Setting	**Register Value**
1200	0x000C
2400	0x0018
4800	0x0030
9600	0x0060
14400	0x0090
19200	0x00C0
28800	0x0120
38400	0x0180
57600	0x0240
76800	0x0300
115200	0x0480

    Modbus address 40203, serial port parity and stop bit:

Parity Setting	**Register's High Byte Value**
None	0x00
Odd	0x11
Even	0x22

Stop-bit Setting	**Register's Low Byte Value**
1 stop bit	0x11
2 stop bits	0x22

11. Once the new comms setting are correct, be sure to change the address switches back to a non-zero setting for normal operation.

Appendix D. Specifications

EMC Approval	EN 55022 EN 55024 EN 61000-3-2 EN 61000-3-3 FCC Part 15	All Models
	EN50121-4	Model 115S-11 only
Operating temperature range	-40 to +60 deg C	All models In C1 D2 and Zone 2 Hazardous Areas
	-40 to +70 deg C	Model 115S-11 when used in non-hazardous locations.
Power supply	10.8 – 30.0 VDC 13.8V / 24VDC nom	***Model Dependent. Check rear label for actual operating voltages***
Supply current (idle 13.8V) -11 -12 -13	 100mA 100mA 120mA	
Supply current for I/O per digital input per digital output per analog input per analog output	 13mA 13mA 50mA 50mA	 If using 24V loop supply
Loop supply	24V nominal *	* Loop supply will follow 115S-xx power supply voltage above 24V input.
Loop supply max current	115S-12 : 270mA 115S-13 : 160mA	
RS232 port	Modbus protocol	
RS485 port	Modbus protocol ELPRO E-Series protocol	
Modbus protocol		
Transmission modes	Modbus ASCII 8 data bits Modbus ASCII 7 data bits** Modbus RTU	** If no parity, use 2 stop bits. If using parity, use 1 stop bit.
Baud rates	1200; 2400; 4800; 9600; 14,400; 19,200; 28,800; 38,400; 57,600; 76,800; 115,200	
Parity	Odd, even, none	
Stop bits	1, 2	
Slave address	Modbus = 01-99	Elpro = 96 - 127. Note: Each module requires 3

		addresses meaning the maximum number of serial modules per radio is 10.
Default settings	If slave address = 0	Modbus RTU, 9600, N, 1
Digital inputs		
On-state voltage	<2.1VDC	
Wetting current	5mA	
Max pulse input rate	1kHz	
Minimum pulse width	0.5mS	
Max pulse input count	4294967295 (32-bit)	
Digital outputs		
Output voltage range	0-30VDC	
Output current max	200mA	
Max pulse output rate	50Hz	
Max pulse output count	65535	
Analog Inputs		
Input voltage range	0-12V	
Voltage resolution	16 bits	
Input current range	0-24mA	
Current resolution	16 bits	
Input impedance (voltage)	100k	
Input impedance (current)	100ohm	
Common mode voltage range	27VDC	
Calibrated accuracy	0.10%	
Analog Outputs		
Output voltage range	0-12V	
Voltage resolution	12 bits	
Output current range	0-24mA	Total output current 160mA
Current resolution	12 bits	
Calibrated accuracy	0.10%	

Table D-1: 115S Specifications.

115S	-11	-12	-13
Digital inputs/outputs	16	8	8
Pulse outputs	8	8	8
Pulse inputs	4	-	-
Analog inputs	-	8	-
Analog outputs	-	-	8

Table D-2: 115S module types and I/O.

Appendix E. RS232 Wiring

The RS232 connection to the 115S modules requires a standard straight-through serial cable (modem cable). The wiring is shown in Figure E-1.

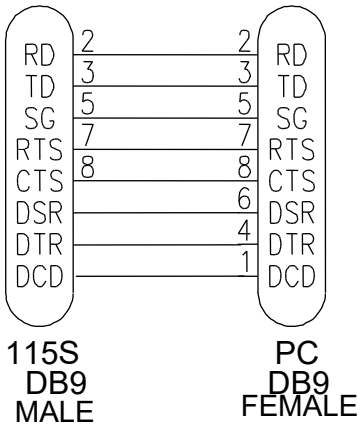

Figure E-1: Wiring for RS232 cable for PC-115S communications.