CIRCULAR SOLUTIONS

Pre-Start Warning

User Manual

Document No. CS-PSWD101

10/2020

Revision 1

CONTENTS

Revision History

Revision	Date	Comment
1.0	13 October 2020	First Issue

1. PREFACE

1.1. FEATURES

The CS-PSW20 Pre-start Warning unit provides both visual and audible warning of pre-start (e.g. conveyor belt startup) and abnormal operating conditions. The unit provides both visual and audible warnings via high intensity LED's and a siren. It can be easily integrated into your control system via EtherNet/IP, Modbus-TCP or alternately via hardwiring.

The unit is pre-configured with multiple operating modes to suit various implementations. These modes are easily selected via DIP switches on the main control board.

The CS-PSW 20 is designed to be able to operate independently of any external control and thus provides the perfect solution for any standalone applications. Abnormal conditions can be used to trigger the unit in a variety of different modes via integrated onboard inputs.

The CS-PSW20 unit is designed operate from either AC (110V or 220V option) or DC (24VDC) power supplies. The unit can be supplied with Red, Amber or Green LED's to suit specific applications. Comprehensive internal and component diagnostics are integrated into the unit to ensure ongoing reliable operations. These diagnostics include validation of the LED and siren functioning. This status can be monitored via communications or alternately via a hardwired output on the unit.

Application:

The Pre-start Warning units are applied across industrial operations to provide pre-start warnings for conveyor belts, pump stations, ventilation fans, compressors, milling, crushing, fire and alarm. The multitude of configurable operational modes makes it suitable for most applications requiring visual and audible warnings.

The LED's and siren units can be independently controlled via EtherNet/IP or Modbus-TCP so are suitable for bespoke applications where specific sequences of LED and siren output are required.

The units can accommodate both AC and DC power inputs thereby reducing required spares holding. They are modular in design so are easily serviced.

The Pre-start Warning module is configured for local use via onboard DIP switches or for remote connectivity via the **Circular Configurator** application. This software utility can be downloaded from www.circularsolutions.co.za free of charge.

1.2. ADDITIONAL INFORMATION

The following documents contain additional information that can assist the user with the module installation and operation.

Resource	Link
Circular Configurator Installation	http://www.circularsolutions.co.za/configurator
User Manual, Datasheet Example Code & UDTs	http://www.circularsolutions.co.za/pre-start-warning
Ethernet wiring standard	www.cisco.com/c/en/us/td/docs/video/cds/cde/cde205_220_420/installation/guide/cde205_220_420_hig/Connectors.html

Table 1.1 – Additional information

1.3. REFERENCES

Resource	Link
Modbus	http://www.modbus.org

Table 1.2 – References

1.4. SUPPORT

Technical support is provided via the Web (in the form of user manuals, datasheets etc.) to assist with installation, operation, and diagnostics.

For additional support the user can use either of the following:

Resource	Link
Contact Us web link	www.circularsolutions.co.za/contact-us
Support email	contact@circularsolutions.co.za

Table 1.3 – Support details

2. INSTALLATION

2.1. MODULE OVERVIEW

The Pre-start Warning device is designed for both indoor and outdoor installation and is equipped with an integral roof to provide additional protection from rain. The unit is fastened directly onto steelwork or walls via the pre-drilled holes on either side, using suitable bolts/fasteners.

Cables (power control and Ethernet) are connected via pre-drilled gland holes at the underside of the unit. A total of three pre-drilled gland holes have been provided.

The interior control and power wiring is accessed by loosening the bolt on the right hand side of the unit and swinging the outside housing open on the hinges. This design ensures that the gland plate and cabling are fixed to the main body, thus eliminating additional stress on cables and wiring during opening. It also provides ample access to the interior to configure dip switches and wire the unit. The unit seals against a lip to ensure minimal dust and moisture ingress.

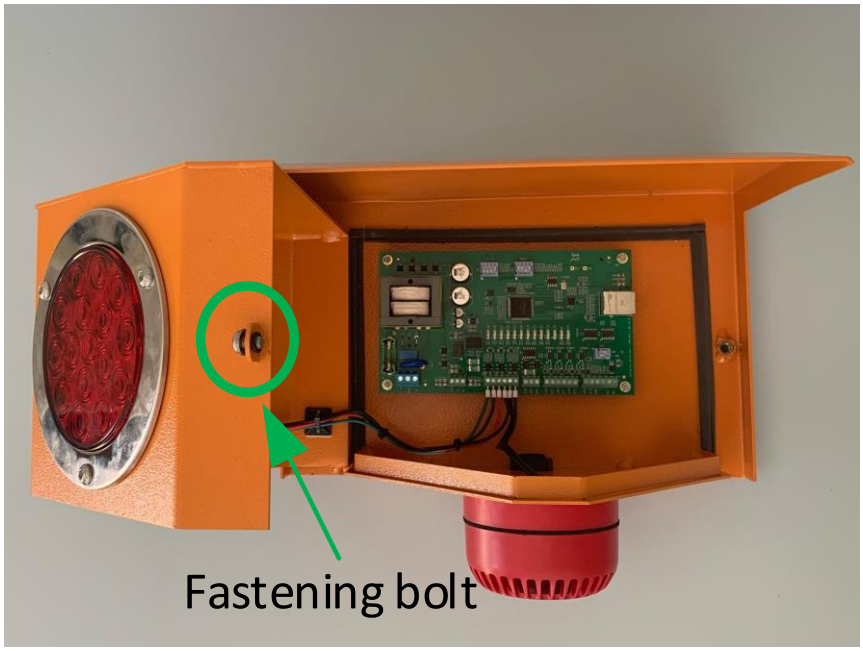

Figure 2.1 – Enclosure in open position

2.2. CONNECTION

The Pre-start Warning unit is pre-wired, pre-assembled and ready for use. Required wiring is limited to the power supply, Ethernet cable and any required interface cables (to PLC or field IO).

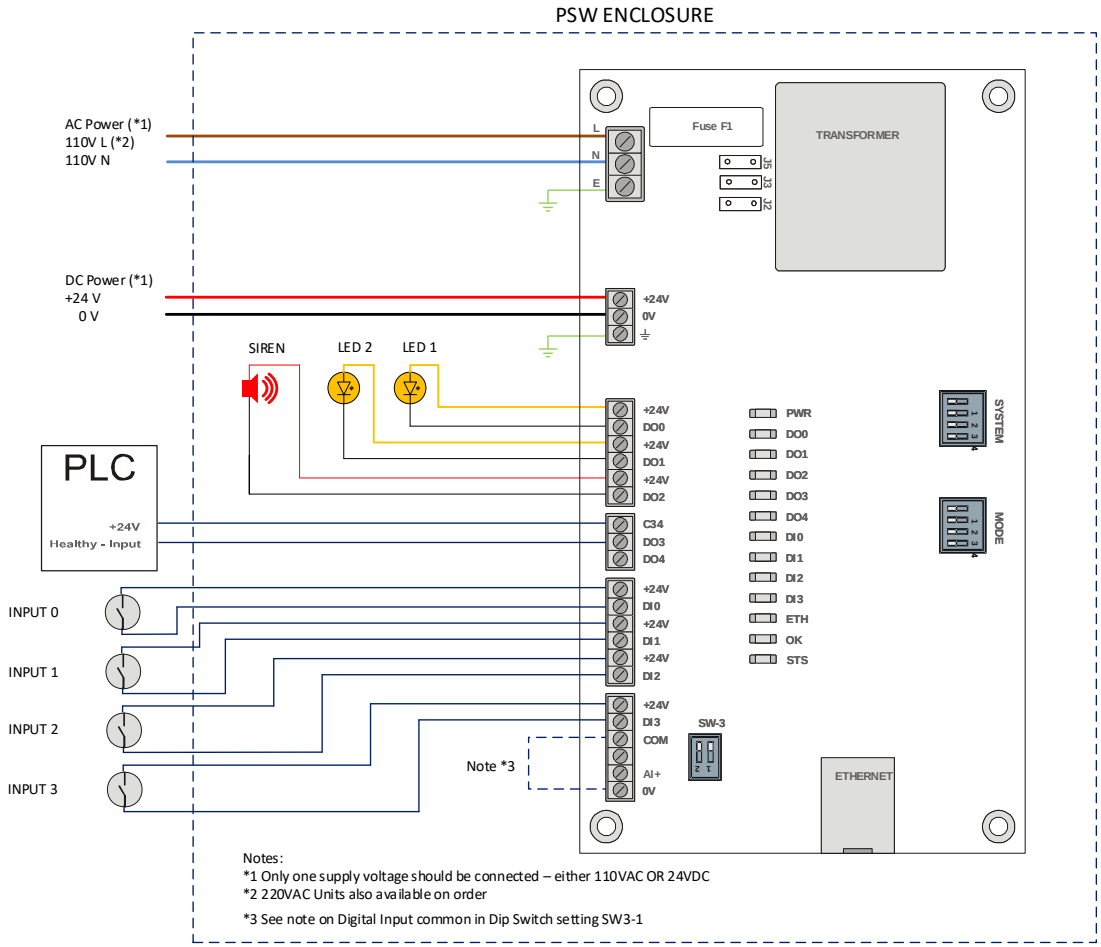

Figure 2.2 – Typical Wiring Diagram

2.3. POWER

Each unit is equipped with both a 24VDC input as well as an AC input (either 110VAC or 220VAC). Only one of the two options is required to be connected.

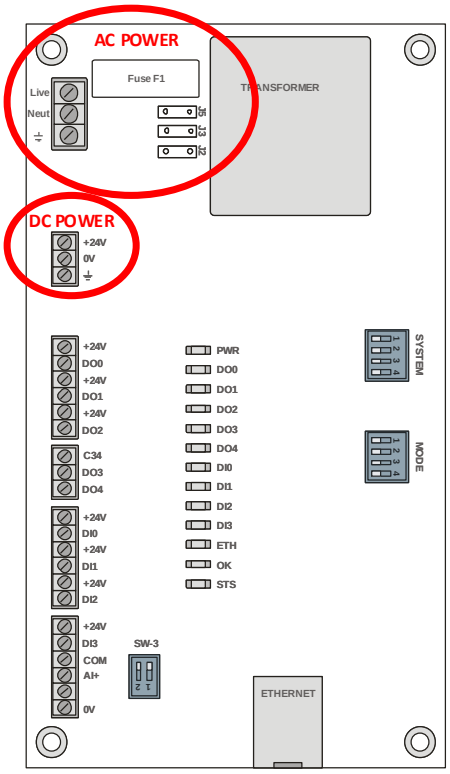

Figure 2.3 – AC & DC Power Circuits

2.3.1. DC INPUT

A three-way power connector is used to connect Power+, Power– (ground), and earth. The module requires an input voltage of 24VDC. Refer to the technical specifications section in this document.

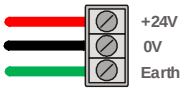

Figure 2.4 – DC Power Connector

2.3.1. AC INPUT

A three-way power connector is used to connect AC Power Live, Neutral and Earth. The unit is configured for either 220VAC or 110VAC depending on option ordered. The module will be labelled with specified AC supply voltage level. Refer to the technical specifications section in this document.

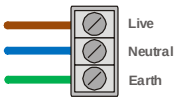

Figure 2.5 – AC Power Connector

The unit is protected from AC supply disturbances by a replaceable 1A fuse as well as a MOV.

The unit's AC rated supply voltage should be confirmed from the label as a well as by confirming the supply jumper configuration.

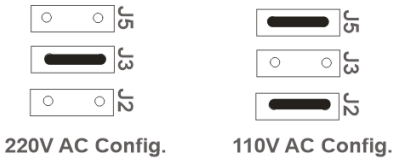

Figure 2.6 – AC Power - Jumper Configuration

NOTE: Ensure that the correct voltage is applied to the unit. Connecting the incorrect voltage to the unit will cause damage and ould result in personal injury.

2.4. IO CONNECTIONS

The Pre-start Warning unit is equipped with four digital inputs and five digital outputs which are connected directly on the labelled terminals on the PCB.

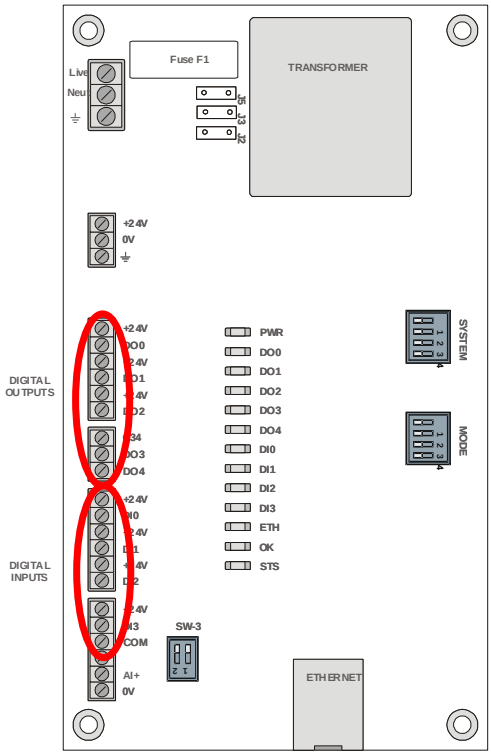

Figure 2.7 – Input and Output Connection

2.4.1. DIGITAL INPUTS

The four digital input channels are optically-isolated sharing a common ground. A voltage of between 10-32 VDC applied to an input will result in a logic on state for that input.

Under many of the operating modes, the digital inputs are not required to be wired. Refer to section 2.6.2 for a detailed description of the wiring requirements for specific operating modes.

Digital Input	Description
DI 0	See section 2.6.2 for operational modes and digital input trigger requirements.
DI 1	See section 2.6.2 for operational modes and digital input trigger requirements.
DI 2	See section 2.6.2 for operational modes and digital input trigger requirements.
DI 3	See section 2.6.2 for operational modes and digital input trigger requirements.

Table 2.1 – Digital Input Description

NOTE: The Digital Inputs are optically isolated and thus the Digital Input Common point is separate to 0V. These can be commoned by setting DIP Switch SW3-1 on or by adding an external jumper.

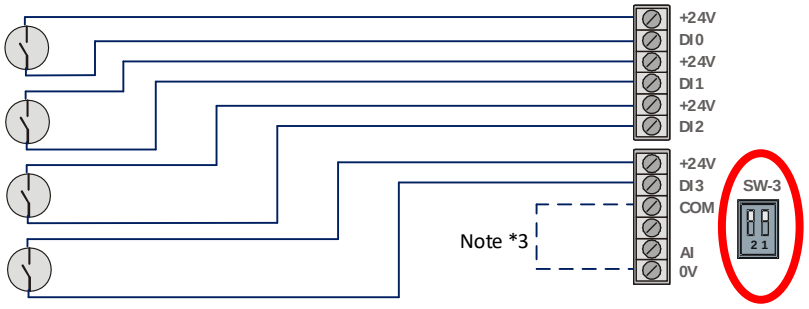

Figure 2.8 – Digital Input Wiring Example

2.4.1. DIGITAL OUTPUTS

There are five digital outputs of which three are used to control the PSW components (LED's and siren). The remaining two relays (D03 & D04) are solid state, normally open, single pole, connected with a single common as shown in figure 2.9 below.

Digital Input	Description
DO 0	Output for control of 24V LED 1. The current on this output is monitored for internal diagnostics of LED health.
DO 1	Output for control of 24V LED 2. The current on this output is monitored for internal diagnostics of LED health.
DO 2	Output for control of the siren. The current on this output is monitored for internal diagnostics of siren health.
DO 3	Fault. This output is normally closed when healthy and opens on detecting a Fault. A fault is defined as an undercurrent condition on a LED or siren or alternatively as an internal system fault. The output will reset to healthy (closed) 30 seconds after fault has rectified.
DO 4	User defined for use with Modbus or EtherNet/IP

Table 2.2 – Digital Output Description

NOTE: Relays 3 & 4 are capable of switching a maximum dc current of 400mA.

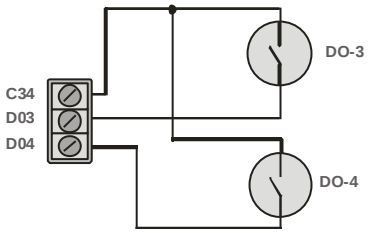

Figure 2.9 – Common Internal Connections of DO3 and DO4

2.5. ETHERNET PORT

The Ethernet connector should be wired according to industry standards. Refer to the additional information section in this document for further details.

2.6. DIP SWITCHES

The module is pre-programmed with multiple different operating modes. These modes are selected via dip switches on the PCB. Three sets of DIP switches are available for configuration as shown in the figure below.

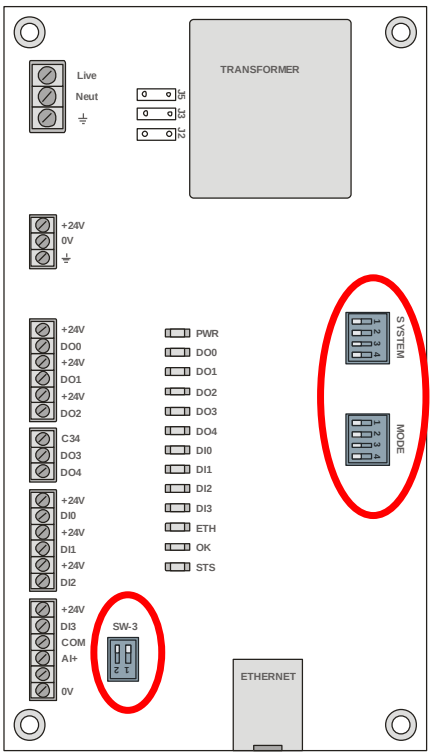

Figure 2.10 – Location of DIP Switches

2.6.1. SYSTEM DIP SWITCHES

System DIP Switch Settings

DIP Switch	Description
DIP Switch 1	Used to force the module into “Safe Mode”. When in “Safe Mode” the module will not load the application firmware and will wait for new firmware to be downloaded. This should only be used in the rare occasion when a firmware update was interrupted at a critical stage.
DIP Switch 2	This will force the module into DHCP mode which is useful when the user has forgotten the IP address of the module.
DIP Switch 3	This will force the module into a fixed IP address – 192.168.1.100
DIP Switch 4	This allows selection between Fast and Slow LED flashing. 0 - (fast) provides LED flashing duration of 250ms (on) with an interval of 250ms 1 - (slow) provides LED flashing duration of 400ms (on) with an interval of 400ms

Table 2.3 – System DIP Switch Settings

2.6.2. MODE DIP SWITCHES

These dip switches are read as a group and not individually. The four switches represent the 16 different settings as per table below:

Mode	DIP Switch 1-4	Description	LED Behaviour DO0 & DO1	Siren Behaviour DO2	Output 3 DO3
0	0000	Alarm on Powerup-Legacy	On - sustained	On. If DI3 = On, then auto-off after 45 seconds	On if no fault (*1)
1	0001	Alarm on Powerup - Flash	Flash	On. If DI3 = On, then auto-off after 45 seconds	On if no fault (*1)
2	0010	Alarm on Powerup Railroad Flash (*2)	Railroad Flash (*2)	On. If DI3 = On, then auto-off after 45 seconds	On if no fault (*1)
3	0011	Alarm on IO – Solid	On if DI0 = on OR DI1 = off (*3)	On if DI2 = on OR DI3 = off (*3)	On if no fault (*1)
4	0100	Alarm on IO – Flash	On if DI0 = on OR DI1 = off (*3)	On if DI2 = on OR DI3 = off (*3)	On if no fault (*1)
5	0101	Alarm on IO – Railroad	On if DI0 = on OR DI1 = off (*3)	On if DI2 = on OR DI3 = off (*3)	On if no fault (*1)
6	0110	Hardwire Control	DO0 = DI0 DO1 = DI1	DO2 = DI2	On if no fault (*1)
7	0111	Reserved			
8	1000	Reserved			
9	1001	Reserved			
10	1010	Reserved			

Mode	DIP Switch 1-4	Description	LED Behaviour DO0 & DO1	Siren Behaviour DO2	Output 3 DO3
11	1011	Reserved			
12	1100	Modbus Control	Modbus Control	Modbus Control	Modbus Control
13	1101	Modbus Control with Comms Fail (*4)	Modbus Control	Modbus Control	Modbus Control
14	1110	PLC/EtherNet Control	PLC Control	PLC Control	PLC Control
15	1111	PLC/EtherNet Control with Comms Fail (*4)	PLC Control	PLC Control	PLC Control

Table 2.4 – Mode DIP Switch Settings

Note 1: "Fault" condition is defined as an undercurrent condition on a LED or siren indicating a faulty component. This output is normally closed when healthy and opens on detecting a Fault. When not in PLC control (mode 14 or 15) then this bit will be auto reset after 30s.

Note 2: "Railroad" mode is defined as LED's flashing alternately.

Note 3: This dual input trigger feature allows flexibility to trigger the unit for either a NO or NC contact in the field. This will typically be an external input that indicates an abnormal condition requiring attention. Example - A contact from a sump level switch (sump level high) triggers the PSW in Modes 3, 4 and 5 to provide a visual and audible warning. Depending on whether the input is a normal open or normally closed contact, it will be wired to either input DI0 or DI1 with the other input bridged.

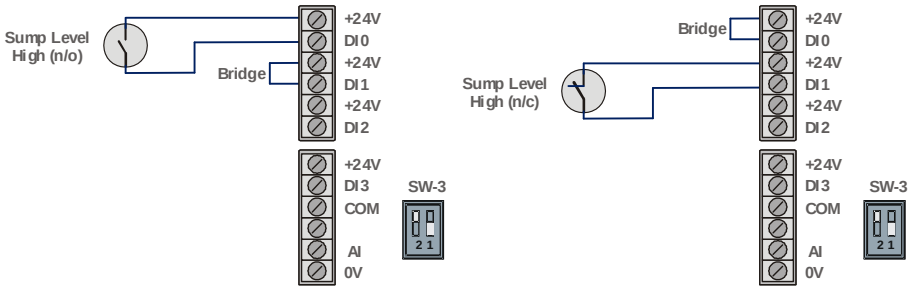

Figure 2.11 – Example of wiring to trigger device for n/o or n/c contact

Note 4: When Comms Fail mode is selected the unit will retain its last known status in the event of a communications failure.

2.6.1. SW3 DIP SWITCHES

DIP Switch	Description
DIP Switch 1	Used to common the Digital input common (DI COM) to the internal 0V. When in the off position, the DI COM is isolated from the internal 0V and the inputs are designed to operate from an external power supply. In this mode, if no external power supply is used, a bridge is required between DI COM and 0V.
DIP Switch 2	Used to toggle the analogue input from 4-20mA to 0-10V. 0 = 4-20mA, 1 = 0-10V

Table 2.5 – SW3 DIP Switch Settings

3. SETUP

3.1. INSTALL CONFIGURATION SOFTWARE

All the network setup and configuration of the module is achieved by means of the Circular Configurator device configuration environment. This software can be downloaded from http://www.circularsolutions.co.za/configurator

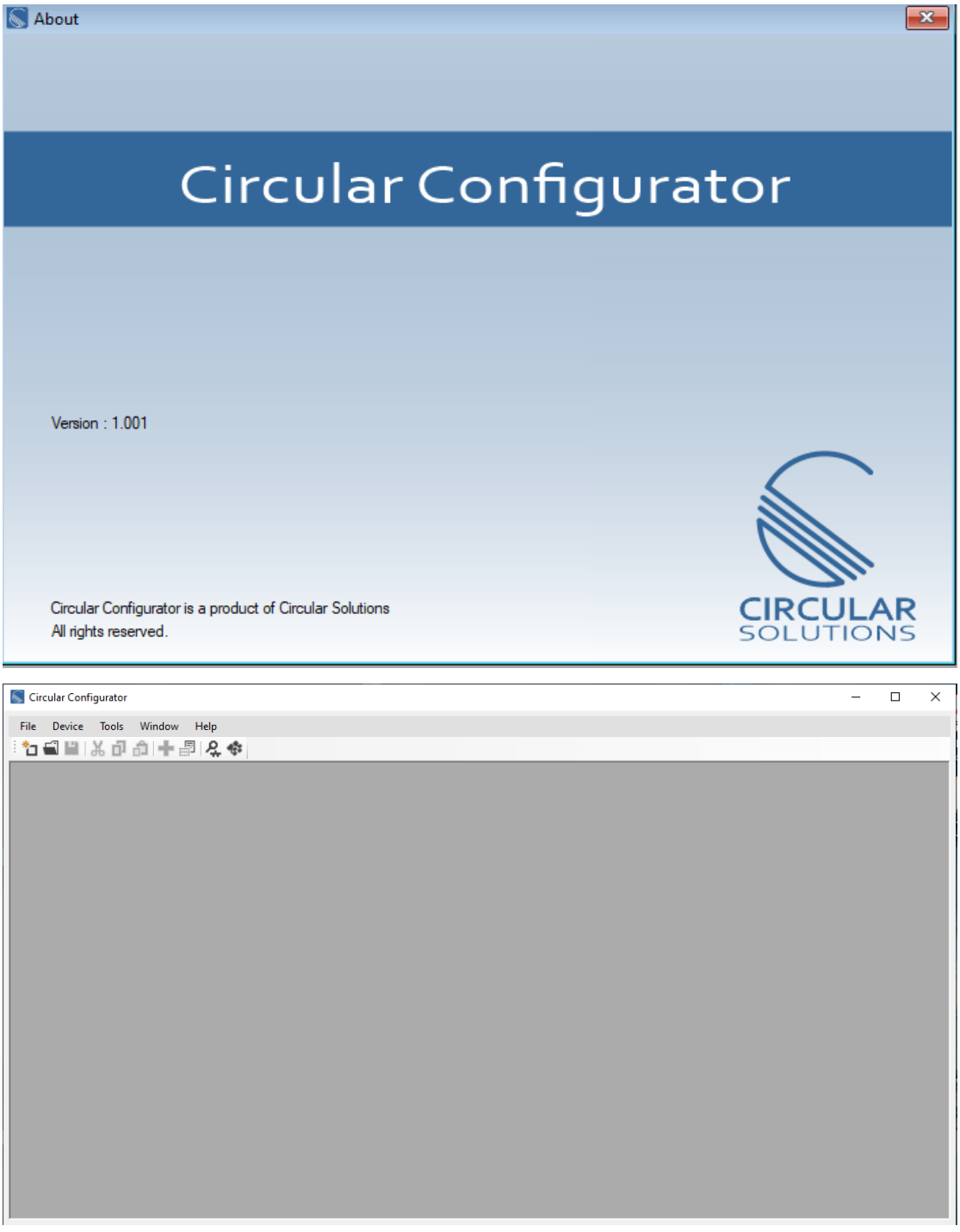

Figure 3.1. Circular Configurator Environment

3.2. NETWORK PARAMETERS

The module will have DHCP (Dynamic Host Configuration Protocol) enabled as a factory default. Thus, a DHCP server must be used to provide the module with the required network parameters (IP address, subnet mask, etc.). There are several DHCP utilities available, however it is recommended that the DHCP server in Circular Configurator be used.

Within the Circular Configurator environment, the DHCP Server can be found under the Tools menu.

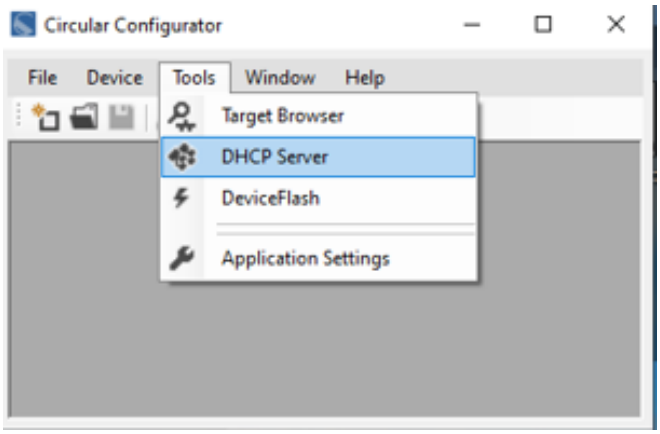

Figure 3.2. - Selecting DHCP Server

Once opened, the DHCP server will listen on all available network adapters for DHCP requests and display their corresponding MAC addresses.

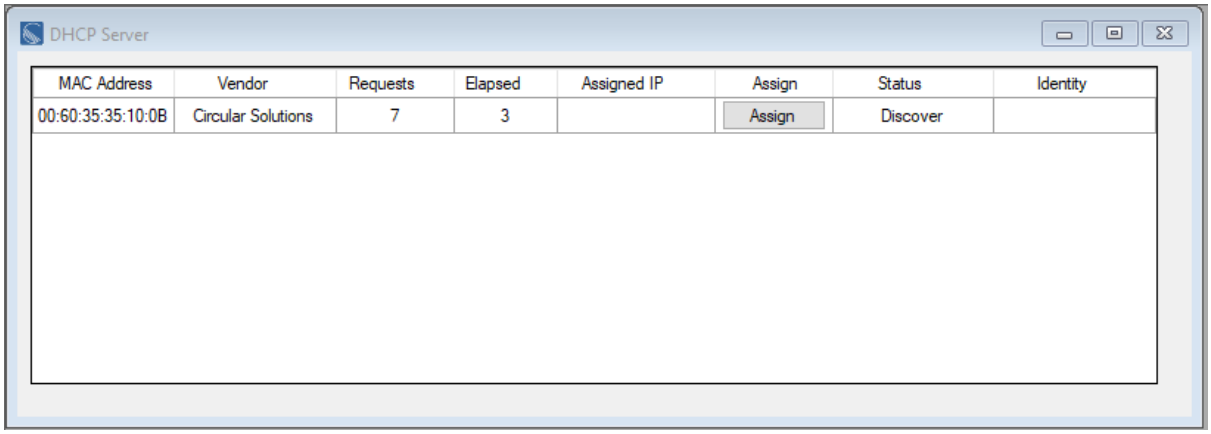

Figure 3.3. - DHCP Server

NOTE: If the DHCP requests are not displayed in the DHCP Server it may be due to the local PC's firewall. During installation the necessary firewall rules are automatically created for the Windows firewall. Another possibility is that another DHCP Server is operational on the network and it has assigned the IP address.

To assign an IP address, click on the corresponding ***Assign*** button. The IP Address Assignment window will open.

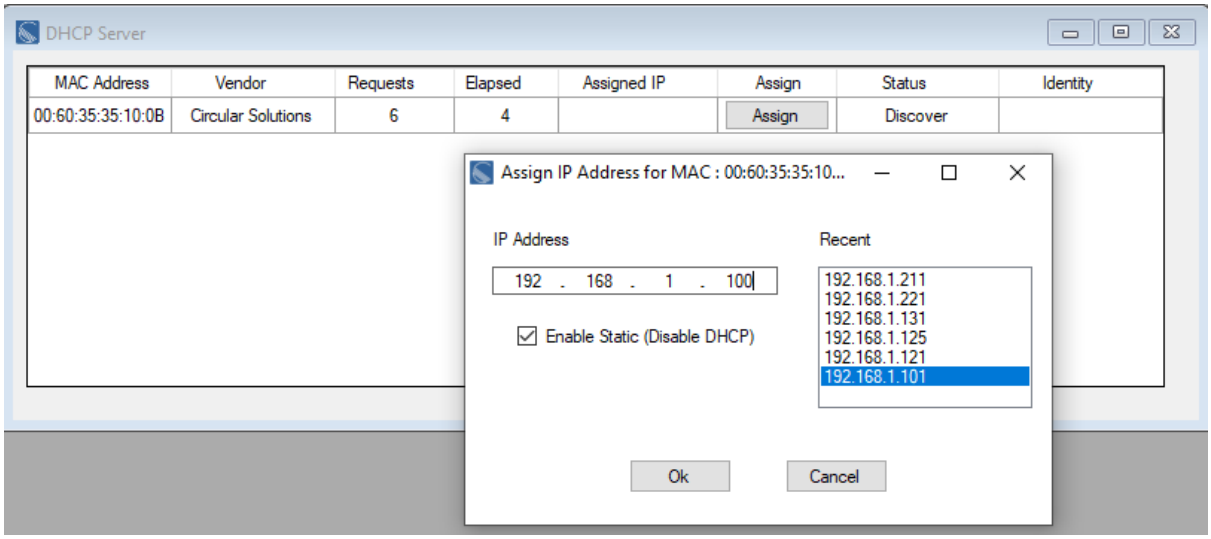

Figure 3.4. - Assigning IP Address

The required IP address can then be either entered, or a recently used IP address can be selected by clicking on an item in the ***Recent*** List. If the ***Enable Static*** checkbox is checked, then the IP address will be set to static after the IP assignment, thereby disabling future DHCP requests.

Once the IP address window has been accepted, the DHCP server will automatically assign the IP address to the module and then read the Identity Object Product name from the device.

The successful assignment of the IP address by the device is indicated by the green background of the associated row.

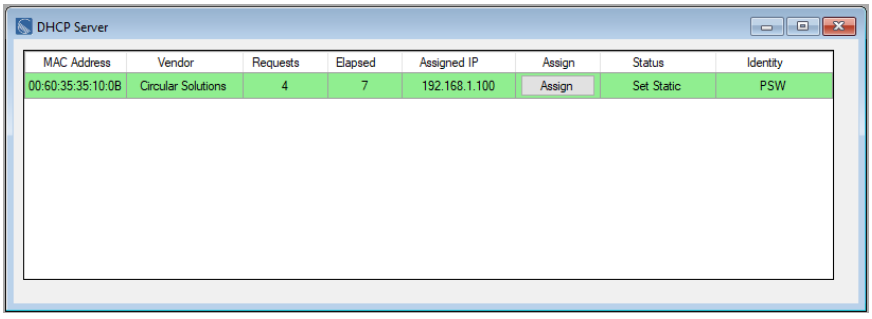

Figure 3.5. - Successful IP address assignment

It is possible to force the module back into DHCP mode by powering up the device with DIP switch 2 set to the “On” position.

A new IP address can then be assigned by repeating the previous steps.

NOTE: It is important to return DIP switch 2 back to Off position, to avoid the module returning to a DHCP mode after the power is cycled again.

In addition to the setting the IP address, a number of other network parameters can be set during the DHCP process. These settings can be viewed and edited in Circular Configurator’s Application Settings, in the DHCP Server tab.

Once the DHCP process has been completed, the network settings can be set using the Ethernet Port Configuration via the ***Target Browser***. The Target Browser can be accessed under the ***Tools*** menu.

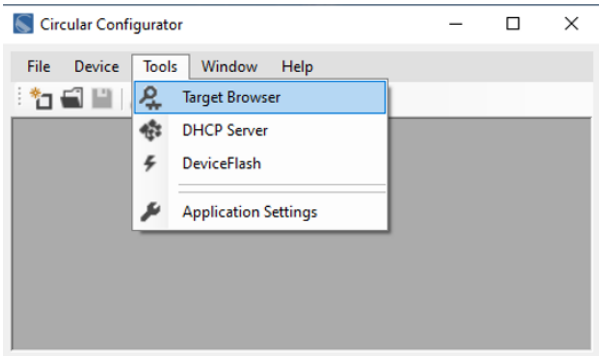

Figure 3.6. - Selecting the Target Browser

The Target Browser automatically scans the Ethernet network for EtherNet/IP devices.

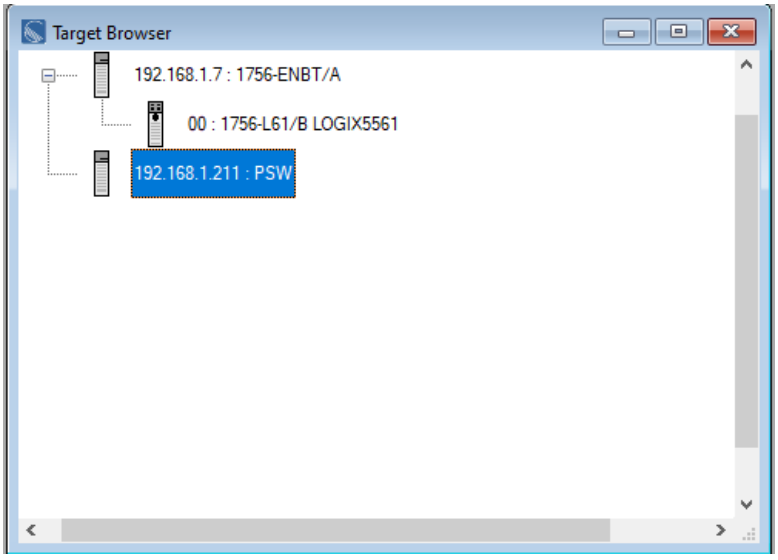

Figure 3.7. - Target Browser

Right-clicking on a device, reveals the context menu, including the ***Port Configuration*** option.

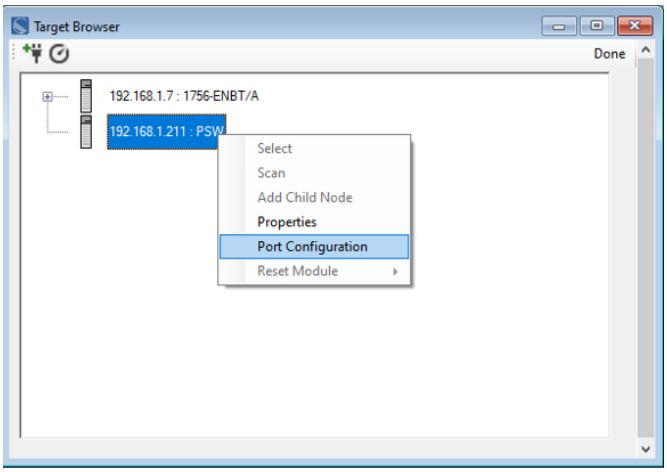

Figure 3.8. - Selecting Port Configuration

All the relevant Ethernet port configuration parameters can be modified using the Port Configuration window.

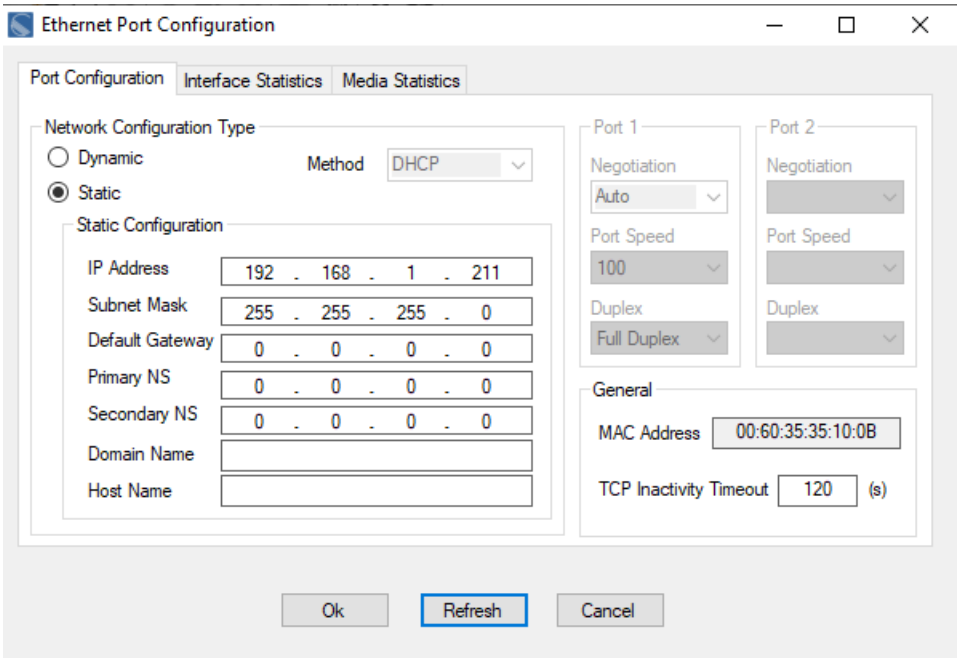

Figure 3.9. - Port Configuration

Alternatively, these parameters can be modified using Rockwell Automation's RSLinx software.

3.3. LOGIX INTEGRATION

The Pre-start Warning Device can be easily integrated with Allen-Bradley Logix family of controllers.

3.3.1. ADD MODULE TO I/O CONFIGURATION

The Pre-start Warning must be added to the RSLogix 5000 / Studio 5000 I/O tree as a generic Ethernet module. This is achieved by right clicking on the Ethernet Bridge in the RSLogix 5000 and selecting New Module after which the ETHERNET-MODULE is selected to be added as shown in the figure below.

NOTE: See the next section for importing the configuration (L5X).

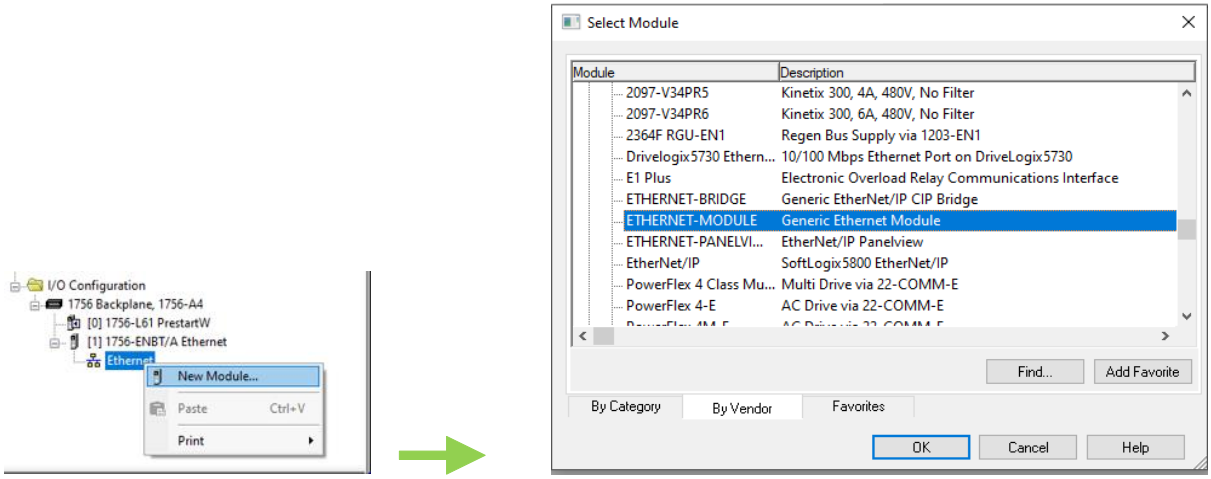

Figure 3.10 - Add a Generic Ethernet Module in RSLogix 5000

The user must enter the IP address of the Pre-start Warning module that has been configured. The assembly instance and size must also be added for the input, output, and configuration in the connection parameters section.

The required connection parameters for the Pre-start Warning module are shown below:

Connection Parameter	*Assembly Instance*	*Size*
Input	168	92 (8-bit)
Output	169	20 (8-bit)
Configuration	102	0 (8-bit)

Table 3.1 - RSLogix class 1 connection parameters

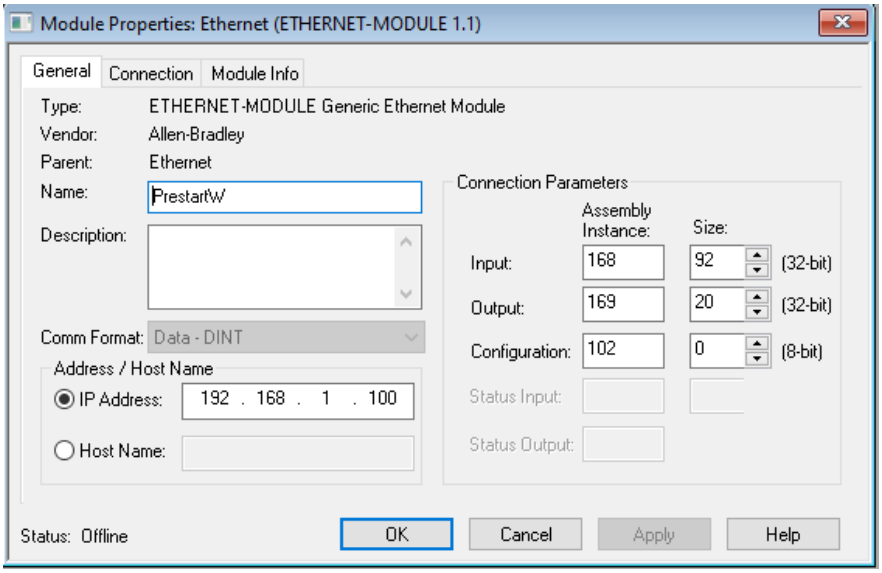

Figure 3.11 - RSLogix 5000 General module properties for Pre-start Warning

Next the user needs to add the connection requested packet interval (RPI). This is the rate at which the input and output assemblies are exchanged. The recommended value is 100ms.

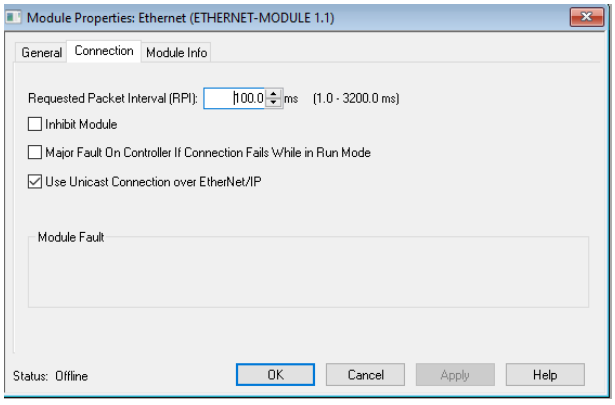

Figure 3.12 - Connection module properties in RSLogix 5000

Once the module has been added to the RSLogix 5000 I/O tree the user must assign the User Defined Types (UDTs) to the input and output assemblies. The user can import the required UDTs by right-clicking on User-Defined sub-folder in the Data Types folder of the I/O tree and selecting Import Data Type. The assemblies are then assigned to the UDTs with a ladder copy instruction (COP) as shown in the figure below.

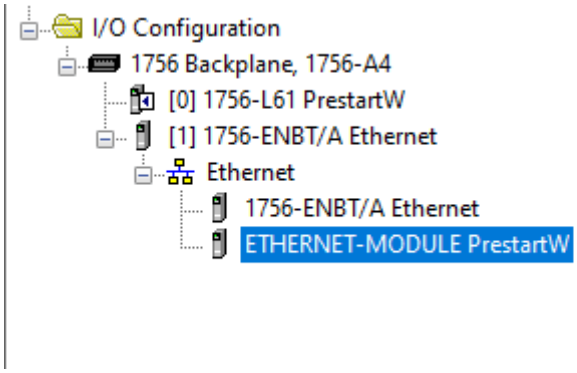

Figure 3.13 – RSLogix 5000 I/O module tree

3.3.1.1. IMPORTING UDTS AND MAPPING ROUTINES

To simplify the mapping of the input image, a RSLogix 5000 Routine Partial Import (L5X) file is provided. This file can be imported by right-clicking on the required Program and selecting the Import Routine option.

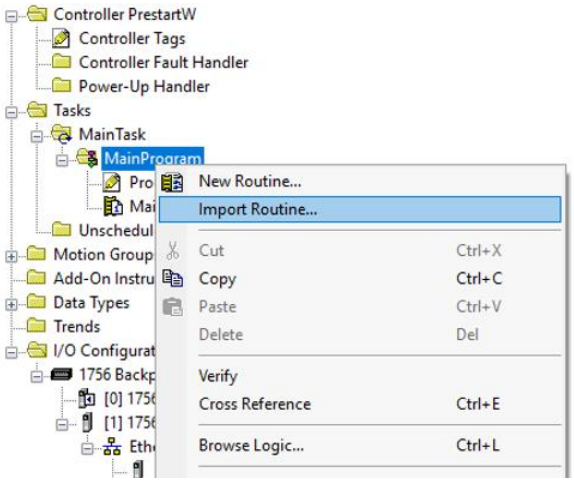

Figure 3.14. – RSLogix 5000 Importing Pre-start Warning specific routine and UDTs

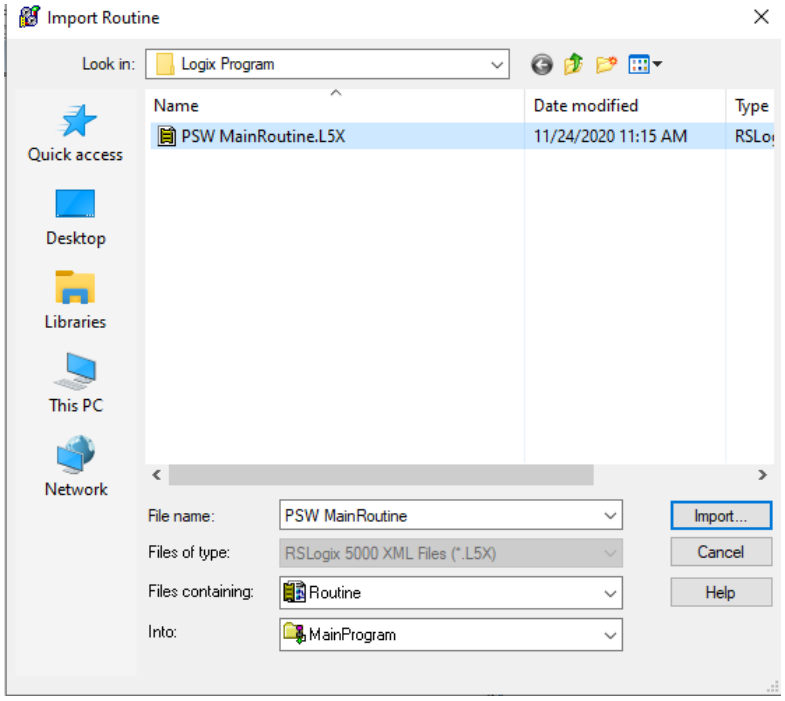

Figure 3.15. - Selecting partial import file

The import will create the following:

- The required UDTs (user defined data types) and Strings
- Controller tags representing the Input and Output assemblies.
- A routine mapping the Pre-start Warning module to the aforementioned tags.

The user may need to change the routine to map to the correct Pre-start Warning module instance name, and make sure that the mapping routine is called by the Program's Main Routine.

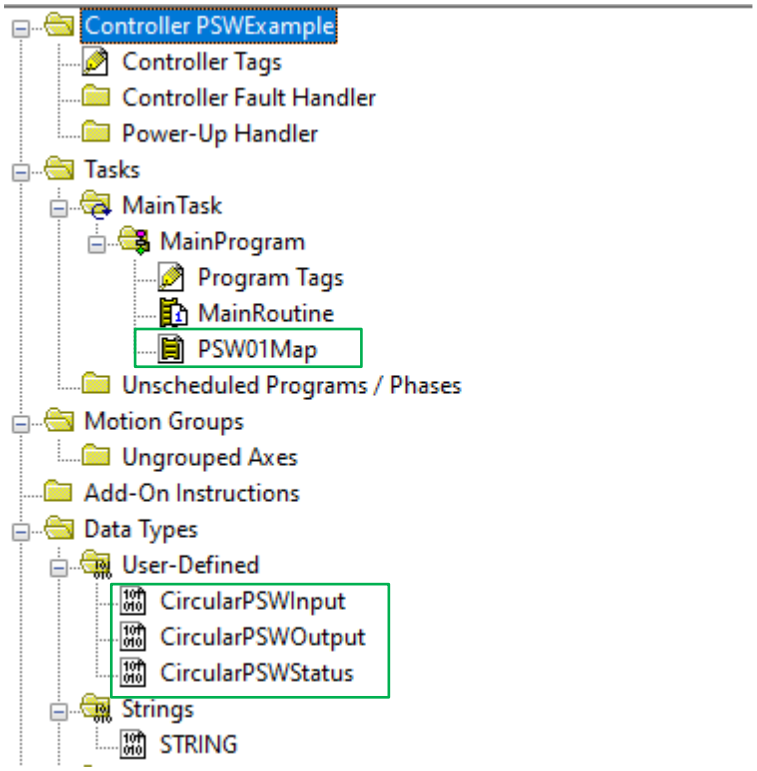

Figure 3.16. - Imported RSLogix 5000 objects

Refer to the additional information section of this document for an example RSLogix 5000 project as well as the required UDTs.

The input assembly items are described in chapter 4.

4. LOGIX MAPPING

The Pre-start module can be added in the Logix IO tree to provide diagnostics information to the Logix controller. The Logix controller will establish a class 1 cyclic communication connection with the module. An input and output assembly is exchanged at a fix interval.

As described in chapter 3, by copying the module's input assembly to the supplied UDT, the following structured parameters can be extracted:

4.1.1. INPUT ASSEMBLY

The following parameters are used in the input assembly of the Pre-start Warning module.

Parameter	Datatype	Description
Instance	STRING	The instance name of the module that was configured under the general Pre-start Warning module configuration in Circular Configurator.
Input		
General Status	BOOL	Bit 0 - Class 1 owned Bit 1 - Modbus comms OK Bit 2 - LED 1 Fault Bit 3 - LED 1 Fault Latch Bit 4 - LED 2 Fault Bit 5 - LED 2 Fault Latch Bit 6 - Siren Fault Bit 7 - Siren Fault Latch
Mode DIP Switch	SINT	Status of Mode DIP-Switches
System DIP Switch Boot	SINT	Status of System DIP-Switches at power-up
System DIP Switch Current	SINT	Status of System DIP-Switches
Firmware Major Rev	SINT	Major Firmware Revision
Firmware Minor Rev	SINT	Minor Firmware Revision
Firmware Micro Rev	SINT	Micro Firmware Revision
DI Status	SINT	Status of input DI0 to DI3
DO Status	SINT	Status of outputs DO0-DO4
CPU Temperature	REAL	CPU temperature (°C)
UpTime	DINT	Seconds since power-up
HardwareMACaddress	SINT[6]	Ethernet MAC address
Analog Input - Voltage (0-10V)	REAL	Analog Input in Volts (when DIP SW3.2 =0)
Analog Input - Current (0-20mA)	REAL	Analog Input in mA (when DIP SW3.2 =1)

CurrentLED1	REAL	Current consumption of LED 1 (mA)
CurrentLED2	REAL	Current consumption of LED 2 (mA)
CurrentSiren	REAL	Current consumption of Siren (mA)
CurrentLED1On	REAL	Last On Current consumption of LED 1 (mA)
CurrentLED2On	REAL	Last On Current consumption of LED 2 (mA)
CurrentSirenOn	REAL	Last On Current consumption of Siren (mA)
LED 1 Current Fault Counter	DINT	LED 1 Current Fault Counter
LED2 Current Fault Counter	DINT	LED2 Current Fault Counter
Siren Current Fault Counter	DINT	Siren Current Fault Counter
LEDControl Readback	SINT	Echo of Output Assembly
Siren Control Readback	SINT	Echo of Output Assembly
DO3/DO4 Control Readback	SINT	Echo of Output Assembly
ResetStatsCommand Readback	SINT	Echo of Output Assembly

Table 4.1 – Pre-start Warning Logix 5000 input assembly parameters

4.1.1. OUTPUT ASSEMBLY

The following parameters are used in the Output assembly of the Pre-start Warning module.

Output		
LEDControl	REAL	Bit 0 - Off Bit 1 - LED D0 On Bit 2 - LED D1 On Bit 3 - LED Both on Bit 4 - Rail-Road Bit 5 - LED 2 Fault Latch Bit 6 - LED D0 Flash Bit 7 - LED D1 Flash
Siren Control	SINT	Bit 0 - Off Bit 1 - On
DO3 / DO4 Control	SINT	Bit 0 - DO3 Bit 1 - DO4
ResetStatsCommand	SINT	Transition from 0-1 triggers reset stats

Table 4.2 – Pre-start Warning Logix 5000 Output Assembly Parameters

5. MODBUS TCP MAPPING

The Pre-start module can be configured to operate as a Modbus-TCP Slave via the Mode DIP switches (section 2.6.2).

The user will need to enter the IP Address, Slave Node Address and Holding register Start address.

5.1.1. HOLDING REGISTERS

The following parameters are used in the input assembly of the Pre-start Warning module.

Description	Address	Type	Count	Comment
General Status	0	INT	1	
Bit 0 - Class 1 owned		BOOL	0	
Bit 1 - Modbus comms OK		BOOL	0	
Bit 2 - LED 1 Fault		BOOL	0	
Bit 3 - LED 1 Fault Latch		BOOL	0	
Bit 4 - LED 2 Fault		BOOL	0	
Bit 5 - LED 2 Fault Latch		BOOL	0	
Bit 6 - Siren Fault		BOOL	0	
Bit 7 - Siren Fault Latch		BOOL	0	
Reserved	1	INT	1	Reserved for future use.
Mode DIP Switch	2	INT	1	Status of Mode DIP-Switches
System DIP Switch Boot	3	INT	1	Status of System DIP-Switches at power-up
System DIP Switch Current	4	INT	1	Status of System DIP-Switches
Firmware Major Rev	5	INT	1	Major Firmware Revision
Firmware Minor Rev	6	INT	1	Minor Firmware Revision
Firmware Micro Rev	7	INT	1	Micro Firmware Revision
DI Status	8	INT	1	Status of input DI0 to DI3
DO Status	9	INT	1	Status of input DO0 to DO4
CPU Temperature	10	INT	1	CPU temperature (°C)
UpTime	11	DINT	2	Seconds since power-up
HardwareMACaddress	13	SINT[6]	3	Ethernet MAC address
Analog Input - Voltage (0-10V)	16	INT	1	Analog Input in Volts (when DIP SW3.2 =0)
Analog Input - Current (0-20mA)	17	INT	1	Analog Input in mA (when DIP SW3.2 =1)

CurrentLED1 (mA)	18	INT	1	Current consumption of LED 1
CurrentLED2 (mA)	19	INT	1	Current consumption of LED 2
CurrentSiren (mA)	20	INT	1	Current consumption of Siren
CurrentLED1On	21	INT	1	Last On Current consumption of LED 1
CurrentLED2On	22	INT	1	Last On Current consumption of LED 2
CurrentSirenOn	23	INT	1	Last On Current consumption of Siren
LED 1 Current Fault Counter	24	INT	1	LED 1 Current Fault Counter
LED2 Current Fault Counter	25	INT	1	LED 2 Current Fault Counter
Siren Current Fault Counter	26	INT	1	Siren Current Fault Counter
LEDControl Readback	27	INT	1	Echo of LED Control Command
Siren Control Readback	28	INT	1	Echo of Siren Control Command
DO3/DO4 Control Readback	29	INT	1	Echo of DO3/4 Control Command
ResetStatsCommand Readback	30	INT	1	Echo of reset Command
Reserved	31	INT	8	Reserved for future use.

Table 5.1 – Modbus TCP Holding Registers

5.1.1. MONITOR DISCRETE INPUTS

Type	Address	Description	Type	Count
DI	0	General Status - Bit 0 - Class 1 owned	BOOL	1
DI	1	General Status - Bit 1 – Modbus Comms	BOOL	1
DI	2	General Status - Bit 2 - LED 1 Fault	BOOL	1
DI	3	General Status - Bit 3 - LED 1 Fault Latch	BOOL	1
DI	4	General Status - Bit 4 - LED 2 Fault	BOOL	1
DI	5	General Status - Bit 5 - LED 2 Fault Latch	BOOL	1
DI	6	General Status - Bit 6 – Siren Fault	BOOL	1
DI	7	General Status - Bit 7 – Siren Fault Latch	BOOL	1
DI	16	DI Status - DI0	BOOL	1
DI	17	DI Status – DI1	BOOL	1
DI	18	DI Status – DI2	BOOL	1
DI	19	DI Status – DI3	BOOL	1

DI	24	DO Status - DO0	BOOL	1
DI	25	DO Status – DO1	BOOL	1
DI	26	DO Status – DO2	BOOL	1
DI	27	DO Status – DO3	BOOL	1
DI	28	DO Status – DO4	BOOL	1

Table 5.2 – Modbus TCP Discrete Inputs

5.1.1. CONTROL OUTPUTS

Type	Address	R/W	Description	Type	Count	Comment
HR	100	R/W	LEDControl	INT	1	0 – Off 1 - LED DO0 On 2 – LED DO1 On 3 – LED Both on 4 – LED Railroad On 5 – LED DO0 Flash 6 – LED DO1 Flash 7 – Both LED's Flash
HR	101	R/W	Siren Control	INT	1	0 – Off 1 - On
HR	102	R/W	DO3/DO4 Control	INT	1	Bit 0 – DO3 Bit 1 – DO4
HR	103	R/W	ResetStatsCommand	INT	1	Transition from 0-1 triggers reset status

Table 5.3 – Modbus TCP Control

6. DIAGNOSTICS

6.1. LEDS

The module PCB is equipped with multiple diagnostic LEDs as shown in Figure 6.1 - Module Diagnostic LEDs. These LEDs are used to provide information regarding the modules system operation, power supply, the Ethernet interface as well as the status of the inputs and outputs.

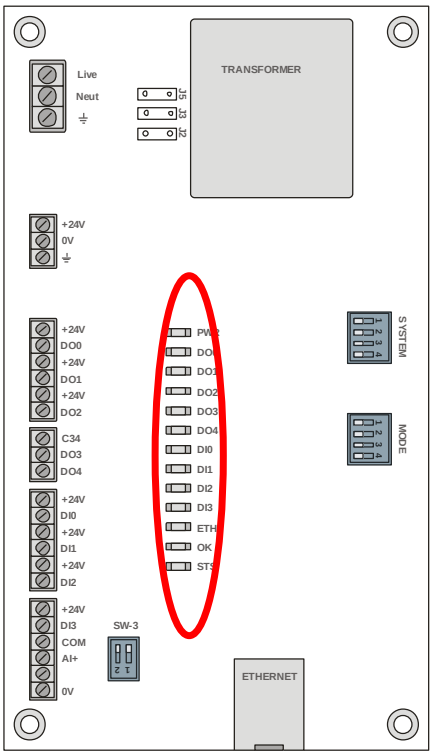

Figure 6.1 - Module Diagnostic LEDs

LED Description	Colour	Description
PWR	Green	Indicates that the unit is powered – either from the 24VDC supply or alternately from the 110/220V AC supply.
DO0	Green	Digital Output – used to power LED1 (left LED unit when facing the front). LED is Green when output is on.
DO1	Green	Digital Output – used to power LED2 (right LED unit when facing the front). LED is Green when output is on.
DO2	Green	Digital Output – used to power siren. LED is Green when output is on.
DO3	Green	Digital Output – used to remotely indicate unit healthy to PLC or other devices. Output is closed when healthy. This output is triggered by internal PCB diagnostics as well as from ongoing checks to ensure healthy operation of siren as well as LED's (current check). LED is Green when

		output is on.
DO4	Green	Digital output – spare. Can be controlled via Modbus or EtherNet for control purposes. LED is Green when output is on.
DI0	Green	Digital Input – used to trigger specific functions from external input. Refer to section 2.6.2 Mode Logic for detail.
DI1	Green	Digital Input – used to trigger specific functions from external input. Refer to section 2.6.2 Mode Logic for detail.
DI2	Green	Digital Input – used to trigger specific functions from external input. Refer to section 2.6.2 Mode Logic for detail.
DI3	Green	Digital Input – used to trigger specific functions from external input. Refer to section 2.6.2 Mode Logic for detail.
ETH	Green	The Ethernet LED will light up when an Ethernet link has been detected (by plugging in a connected Ethernet cable). The LED will flash every time traffic was detected.
OK	Green/Red	The module LED will provide information regarding the system-level operation of the module. If the LED is red, then the module is not operating correctly. For example, if the module application firmware has been corrupted or there is a hardware fault the module will have a red Module LED. If the LED is green (flashing), then the module has booted and is running correctly without any application configuration loaded. If the LED is green (solid), then the module has booted and is running correctly with application configuration loaded.
STS	Green/Red	Status LED When in Modbus-TCP mode, the LED flashes green every time a valid Modbus request is received and flashes red every time an invalid Modbus request is received.

Table 6.1 – Diagnostic LED's

7. TECHNICAL SPECIFICATIONS

7.1. DIMENSIONS

Below are the enclosure dimensions in millimetres.

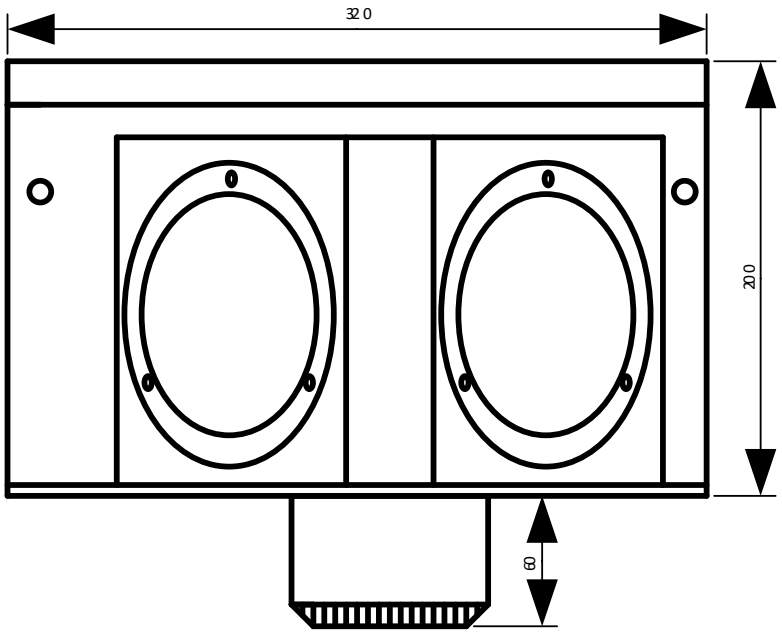

Figure 7.1 – Pre-start Dimensions

7.1. CONSTRUCTION

Specification	Rating
Dimensions (including roof)	Width 320mm Height 200mm Depth 200mm Siren extension 60mm
Material	Mild Steel - Powder Coated (coastal specification)

Table 7.1 – Enclosure Construction Specification

7.2. ELECTRICAL

Specification	Rating
Power requirements	**Input: 24V DC,** 130mA @ 24 VDC (Typical) 250mA @ 24 VDC (Maximum) **Input 110VAC** 32mA @ 110VAC (Typical) 55mA @ 110VAC (Maximum) **Input 220VAC** 16mA @ 24 VDC (Typical) 28mA @ 24 VDC (Maximum)
Power consumption	3.5 W (Typical) 6.0 W (Maximum)
Connector (Power)	24VDC - 3-way terminal (3.81 mm pitch) 110/220VAC - 3-way terminal (5.08 mm pitch)
Conductors	24 – 18 AWG
Temperature	-20 – 70 °C
Earth connection	Yes, terminal based

Table 7.2 - Electrical specification

7.3. ETHERNET

Specification	Rating
Connector	RJ45
Conductors	CAT5 STP/UTP
ARP connections	Max 20
TCP connections	Max 20
CIP connections	Max 10
Communication rate	10/100Mbps
Duplex mode	Full/Half
Auto-MDIX support	Yes

Table 7.3 - Ethernet specification

7.4. DIGITAL INPUTS

Specification	Rating
Number of channels	4
Connector	5-way terminal (3.81 mm pitch)
Type	Optical Isolation
Input impedance	>10 kΩ
Logic 1 Voltage	10 – 32 V

Table 7.4 - Digital Input specification

7.5. RELAY OUTPUTS

Specification	Rating
Number of channels	5
Connector	terminal (3.81 mm pitch)
Type	Solid State - Normally Open Single Pole
Load Current	400 mA (maximum)
Load Voltage	60 Vdc (maximum)

Table 7.5 - Relay Output specification