Belt Rip/Tear Detector

User Manual

Document No. CS-BRTD101

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Revision 2

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Revision History

Revision	Date	Comment
1.0	13 October 2020	First Issue
2.0	23 January 2021	Enclosure details updated

1. PREFACE

1.1. FEATURES

The CS-BRT20 Belt Rip and Tear Detector provides a highly effective means of detecting belt Rip and Tear conditions on conveyor belts. The unit is equipped with a photoelectric beam that passes underneath the conveyor belt. When the beam is broken by torn belt sections, the unit operates and issues a trip command.

The units are ideally placed after both load and offload points on a conveyor belt to ensure early detection close to the most likely damage points. Effective placement has proven to detect most rip/tear conditions and significantly reduce the length of damaged belt.

The CS-BRT20 unit is designed operate from either AC (110V or 220V option) or DC (24VDC) power. Comprehensive internal and component diagnostics are integrated into the unit to ensure ongoing reliable operations. These diagnostics include validation of the photoelectric beam functioning as well as an anti-sabotage feature which prevents the reset button from being permanently engaged/forced. The status of the unit can be monitored via communications or alternately via a hardwired output on the unit.

The Belt Rip and Tear Detectors can be easily integrated into control systems via EtherNet/IP, Modbus-TCP or alternately via hardwiring.

The units are housed in robust polycarbonate housings to ensure maximum resilience in the harsh and normally damp conditions around conveyor belting. Each unit consist of two sensor housings, one positioned on either side of the belt and one control unit. The housings have an ingress protection of IP66 and an IK10 impact rating (Equivalent to impact of 5kg mass dropped from 400 mm above impacted surface).

1.2. APPLICATION

The CS-BRT20 Belt Rip and Tear Detectors are applied on medium to long conveyor belts in industrial and mining applications. They are positioned after loading and offloading points on the conveyor belt, as these are the points where damage is most likely to occur.

Once the photoelectric beam has been broken by a torn piece of conveyor belting, the unit operates and issues a trip output to trip the conveyor belt. This trip output status is sustained, thus preventing the belt from restarting until it has been reset via the Reset pushbutton.

Should the Reset button be forced in the ON position for longer than 10 seconds – the unit will issue a Fault output. The trip output will not be disabled and will still operate under a belt rip condition.

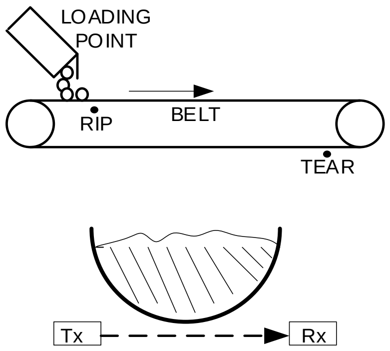

Figure 1.1 – Typical installation positions

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 Belt Rip and Tear Detector 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.

1.3. 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/belt-rip-detector
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

1.4. REFERENCES

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

Table 1.2 – References

1.5. 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 CS-BRT20 Belt Rip and Tear Detector comprises two small sensor enclosures which are installed on either side of the conveyor belt and one control unit. The sensor enclosures are wired back to the control unit which can be mounted in a more accessible location. The control unit houses the primary control unit/board and is the primary interface for the operator as well as to the control system (hardwired and communications). This configuration allows for individual components to be easily replaced should they become damaged.

Figure 2.1 – Receiver and Emitter Enclosures

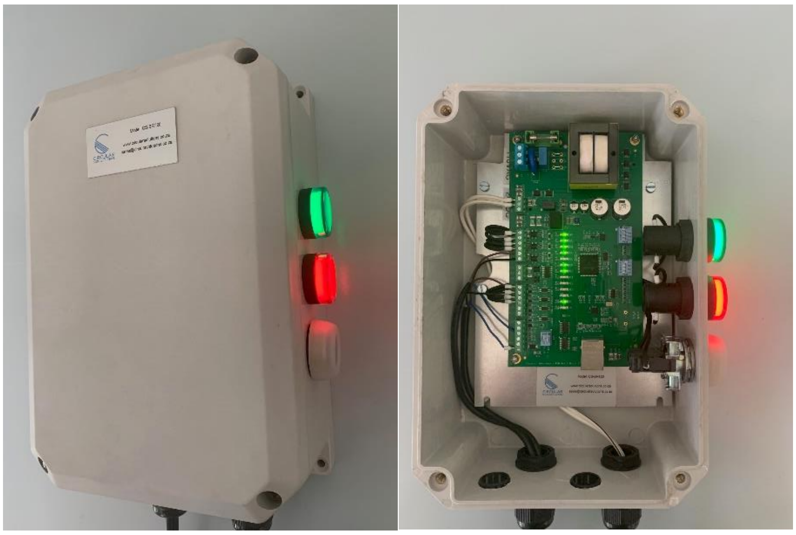

Figure 2.2 – Main Control Enclosures (closed and open)

All of the enclosures (control unit as well as sensor enclosures) are designed for harsh conditions and offer both high ingress protection (IP66) as well as a high impact rating (IK10) (equivalent to impact of 5kg mass dropped from 400 mm above impacted surface).

The Emitter Unit – Enclosure containing emitter sensor complete with 2m sensor cable. This cable should be connected to the Control Unit (either directly or via junction box).

The Receiver Unit – Enclosure containing receiver sensor complete with 2m sensor cable. This cable should be connected to the Control Unit (either directly or via junction box).

The Control Unit – Enclosure containing control board and communications ports. This unit connects to emitter and receiver and serves as the interface to the PLC. It requires a power supply of 24V or 110V (220V on request). This unit is usually mounted to the side of the conveyor where it is easily accessed and the indications and reset button are accessible.

The Belt Rip and Tear detector can operate in a standalone mode with “Trip” and “Fault” outputs being hardwired directly to a PLC or MCC. Alternatively, the units are equipped with onboard EtherNet//IP and Modbus TCP communications as a standard to allow for complete integration into most control systems.

The units have comprehensive onboard self-diagnostics as well as built in sensor testing. They can be easily coupled with the Prestart Warning (CS-PSW20) for visual audible warning.

Anti-sabotage logic has been incorporated to prevent a forced sustained Reset. Should the Reset button be forced in the ON position for longer than 10 seconds – the unit will issue a Fault output. The trip output will not be disabled and will still operate under a belt rip condition.

The Sensor Healthy (Green) and Trip/Fault (Red) LED’s on the primary (receiver) unit are clearly visible to the operator to provide easy fault finding.

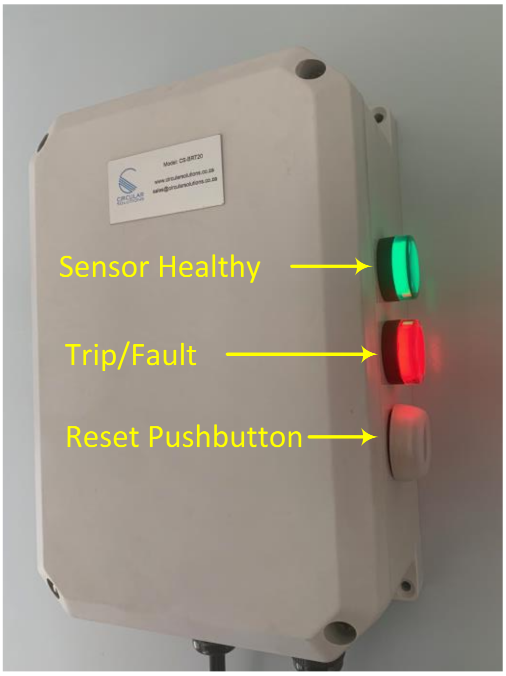

Figure 2.3 – Control Unit Indications: Sensor Healthy (Green) and Trip/Fault Status (RED)

2.1. SENSOR ALIGNMENT

The Emitter and Receiver sensor enclosures are mounted on either side of the conveyor belt. Once connected and power up, the alignment of the units is confirmed when both the GREEN and YELLOW LED's on the receiver sensor are ON (not flashing). This indicates that the signal strength is at least twice that required to energize the output. If the Green LED is flashing or if the Yellow LED is not on, the sensors are not correctly aligned.

Figure 2.4 – Receiver sensor showing sensors are aligned

Ideally the beam should be set approximately 20-25mm underneath the conveyor belt to achieve maximum effectiveness.

2.2. CONNECTION

The Belt Rip Tear units are pre-wired, pre-assembled and ready for use. The device comprises two sensor units, which are mounted on either side of the conveyor belt, and control unit which can be mounted in a more accessible location. Wiring of the sensors can be either direct to the control unit or alternately via a small junction box. The second option allows for more flexibility with location of the Control Unit.

2.2.1. DIRECT SENSOR WIRING OPTION

The two sensor enclosures can be wired directly to the control unit. Typical wiring details for this option are shown in figures below:

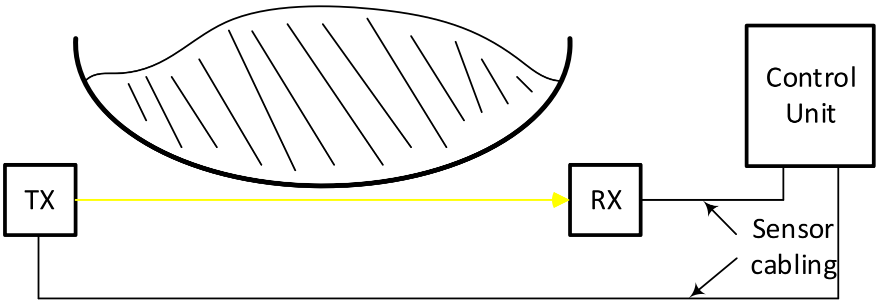

Figure 2.5 – Direct Wiring of Sensors to Control Unit

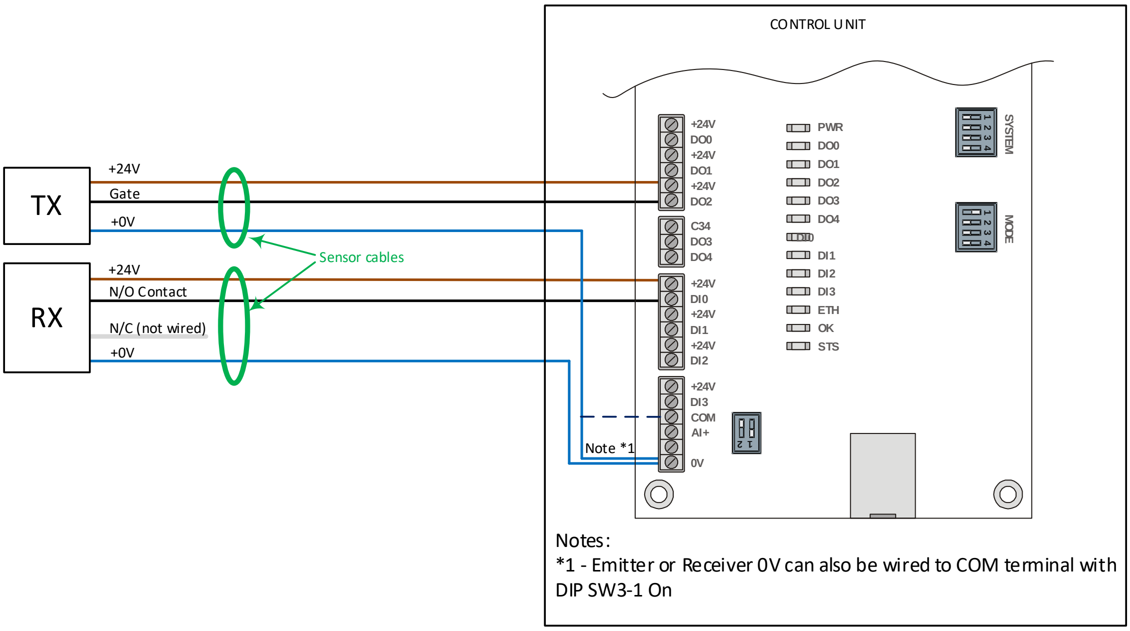

Figure 2.6 – Connection for Direct Wiring of Sensors to Control Unit

NOTE: Ensure that the sensor units are connected with the correct polarity. Incorrect polarity will damage the sensors.

2.2.1. Sensor Wiring Via Junction Box Option (Preferred)

The two sensor enclosures can be wired to the Control Unit via a small junction box. This box is typically installed underneath the conveyor belt and allows for improved flexibility of mounting Control Unit as the distance is not limited by the sensor cable length. Typical wiring details for this option are shown in figures below:

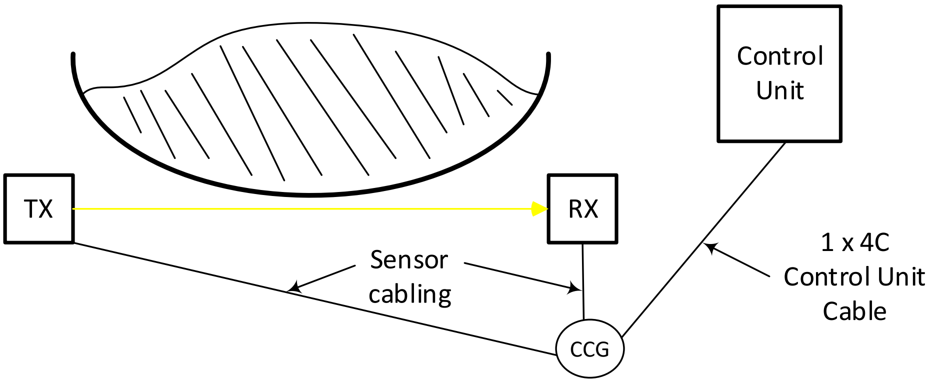

Figure 2.7 – Wiring of Sensors to Control Unit via Junction Box

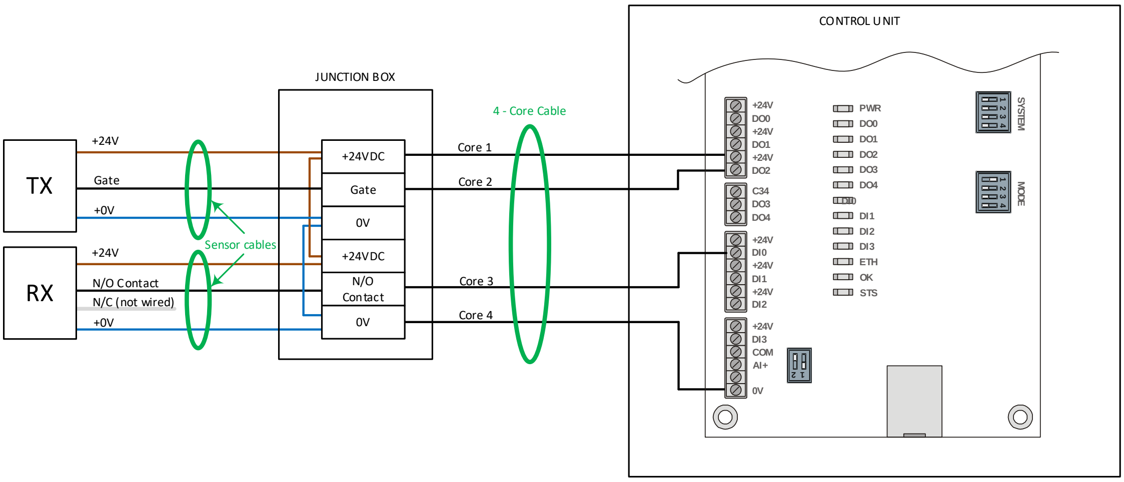

Figure 2.8 – Connection for Wiring of Sensors via Junction Box

NOTE: Ensure that the sensor units are connected with the correct polarity. Incorrect polarity will damage the sensors.

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.**

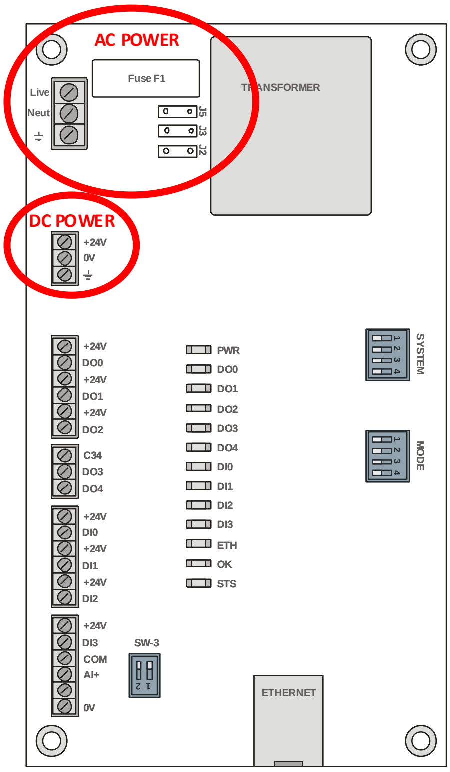

Figure 2.9 – AC & DC Power Circuits

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.

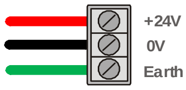

Figure 2.10 – DC Power Connector

2.3.2. 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.

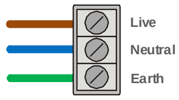

Figure 2.11 – AC Power Connector

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.

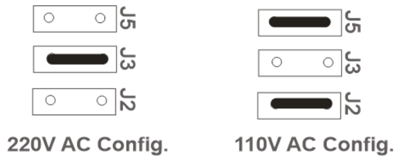

Figure 2.12 – AC Power - Jumper Configuration

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 Belt Rip and Tear Detector unit is equipped with four digital inputs and five digital outputs which are connected directly on the labelled terminals on the PCB.

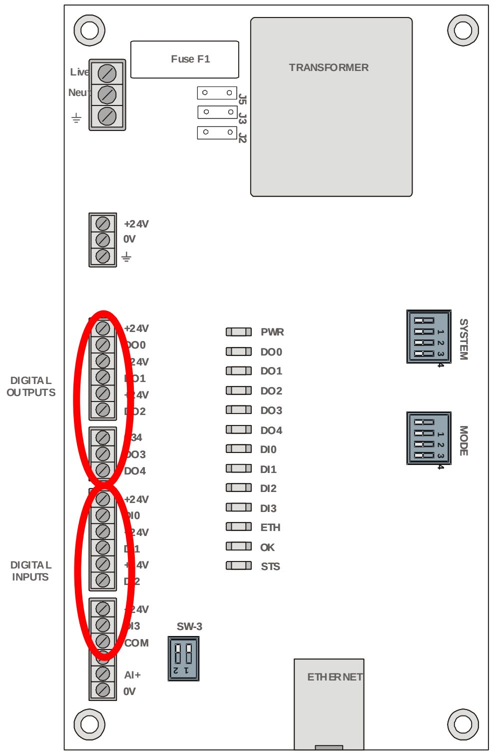

Figure 2.13 – Input and Output Connection

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.

Digital Input	Description
DI 0	Sensor beam received and healthy
DI 1	Reset Pushbutton.
DI 2	Reserved
DI 3	Reserved

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.

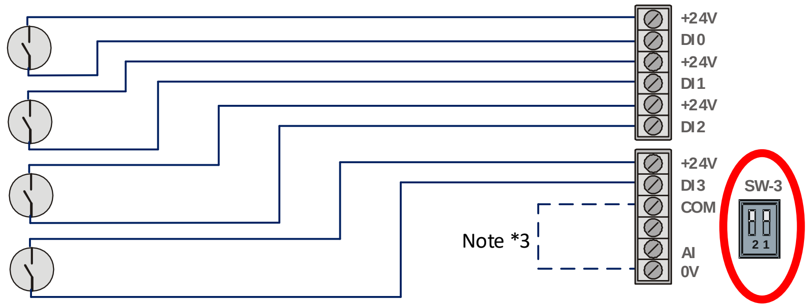

Figure 2.14 – Digital Input Wiring Example

2.4.2. Digital Outputs

There are five digital outputs of which three are used to control the BSR components (Indication LED's and Sensor Trigger). 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. These are used for hardwired interfacing to the PLC or remote control circuit.

Digital Input	**Description**
DO 0	Output for control of 24V SENSOR HEALTHY LED (Green). This LED is on when a healthy beam signal is received by the receiver sensor. It indicates that there is a clear path between emitter and receiver sensors.
DO 1	Output for control of 24V TRIP/FAULT LED (Red). This LED is on when a Trip signal has been received (Sensor beam broken), the reset button has been retained in the On position, or when an internal unit fault has been diagnosed. Once triggered, it will remain on until the unit is reset locally or via communications.
DO 2	Output for testing sensor operation. This output is used to trigger the emitter sensor.
DO 3	TRIP Output to PLC. Operates when beam has been broken – belt rip detected. This is a latched output and is reset via Reset pushbutton or via communication. **Used to trip conveyor belt**. Contact can be selected a N/O or N/C via DIP switches in Section 2.6.2
DO 4	FAULT Output to PLC. Operates for device fault (unit fault) or when reset pushbutton is retained (forced in reset position). Output latches and is reset via pushbutton or via communication. Contact can be selected a N/O or N/C via DIP switches in Section 2.6.2

Table 2.2 – Digital Output Description

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

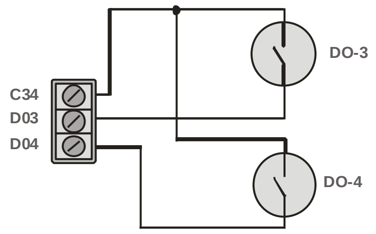

Figure 2.15 – Common Internal Connections of DO3 and DO4

2.4.3. PLC INTERFACE

As detailed in section 2.4.2 Digital Outputs, the hardwired PLC interface is via Digital Outputs 3 & 4. Typical connection is as per Figure 2.16 – PLC Interface Wiring.

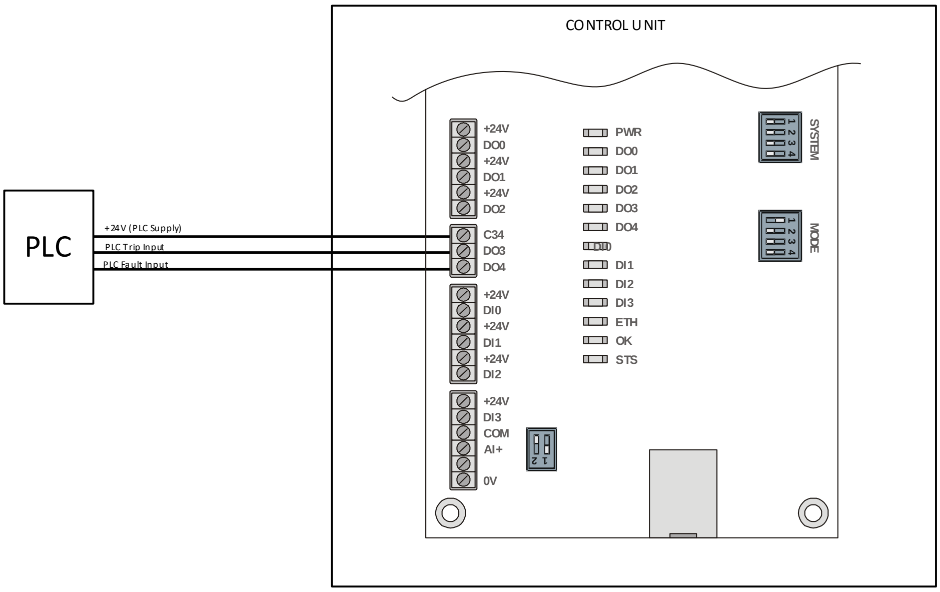

Figure 2.16 – PLC Interface Wiring

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. These sets art lablled as “System”, “Mode” and “SW3”. Detailed operation of these DIP switches are provided in the following section.

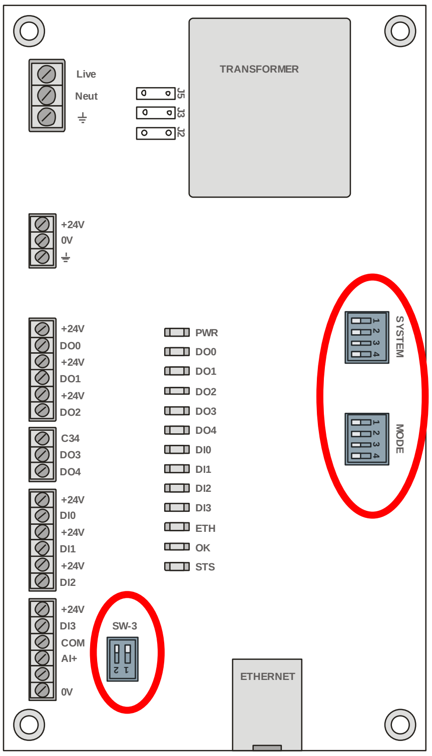

Figure 2.17 – Location of DIP Switches

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. 0 = Normal 1 = Safe Boot Mode
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. 0 = Normal 1 = Force DHCP

DIP Switch 3	This will force the module into a fixed IP address – 192.168.1.100 0 = Normal 1 = Force Fixed IP
DIP Switch 4	This selects the PLC communications protocol. 0 = EtherNet/IP 1 = Modbus TCP

Table 2.3 – System DIP Switch Settings

2.6.2. MODE DIP SWITCHES

Mode DIP Switch Settings

DIP Switch	Description
DIP Switch 1	Reserved – to be set to 1
DIP Switch 2	Reserved
DIP Switch 3	Trip Output (DO3) contact status **(*1)** 0 = Contact closed for Healthy (no Trip) 1 = Contact open for Healthy (no Trip)
DIP Switch 4	Fault Output (DO4) contact status **(*2)** 0 = Contact closed for Healthy (no Fault) 1 = Contact open for Healthy (no Fault)

Table 2.4 – Mode DIP Switch Settings

Note 1: “Trip” condition is triggered and latched for a detected belt rip condition. This is used to Trip the conveyor belt.

Note 2: “Fault” condition indicates a Reset Forced condition or a unit diagnostic fault (Beam sensor fault or unit fault).

2.6.3. 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. 0 = DI COM and 0V isolated 1 = DI Com and 0V common
DIP Switch 2	Not used for this device.

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*

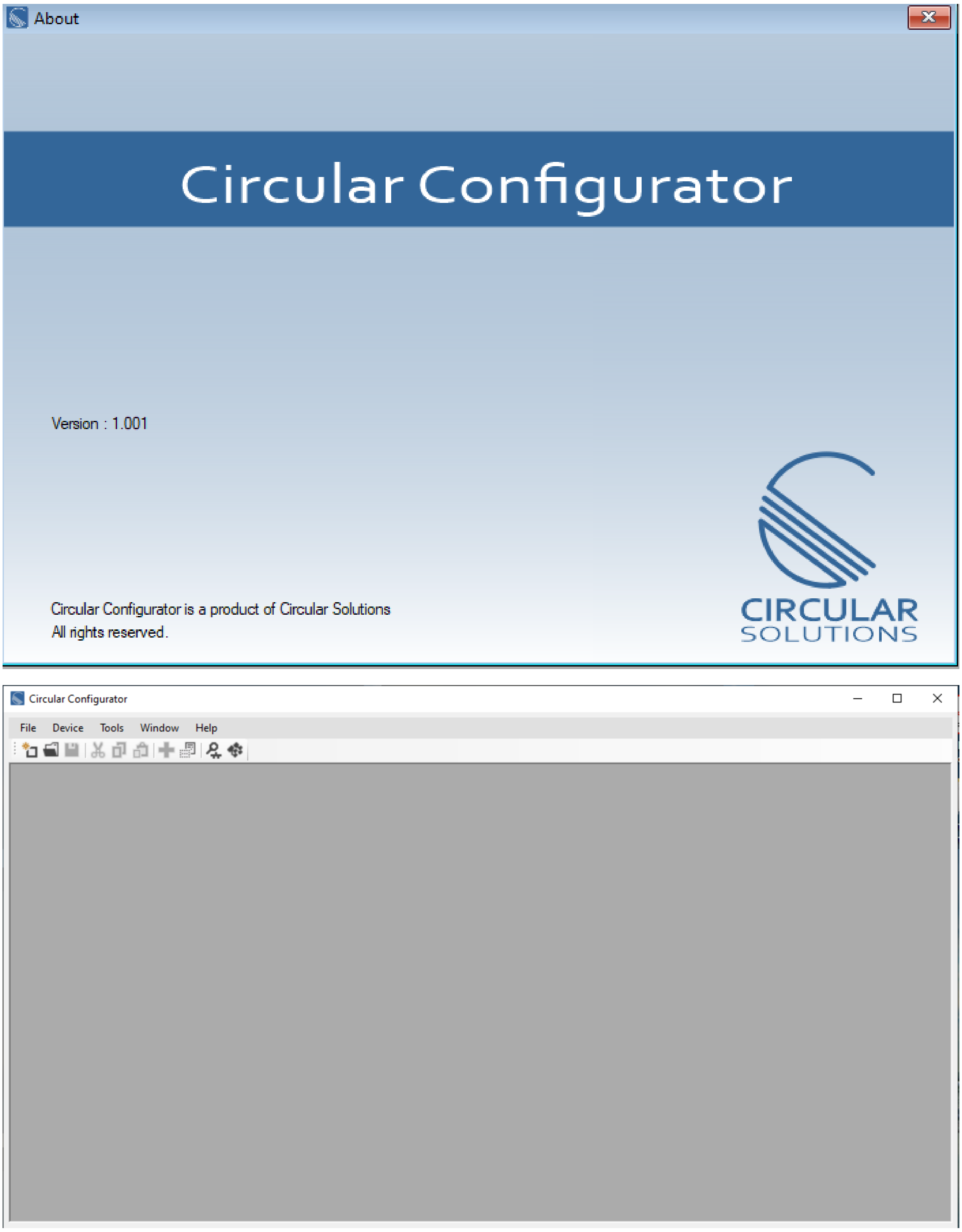

Figure 3.1. Circular Configurator Environment

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.

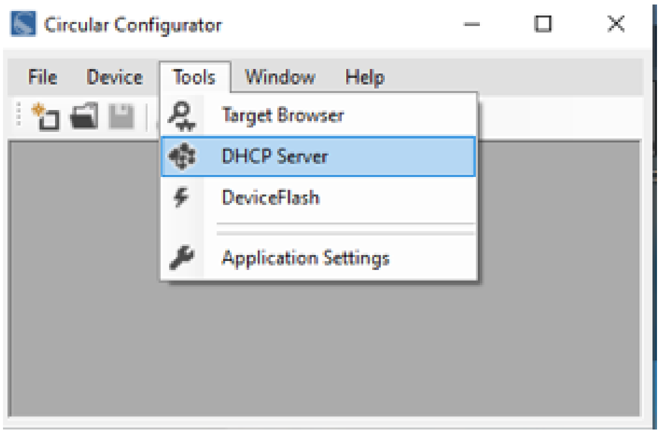

Figure 3.2. - Selecting DHCP Server

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

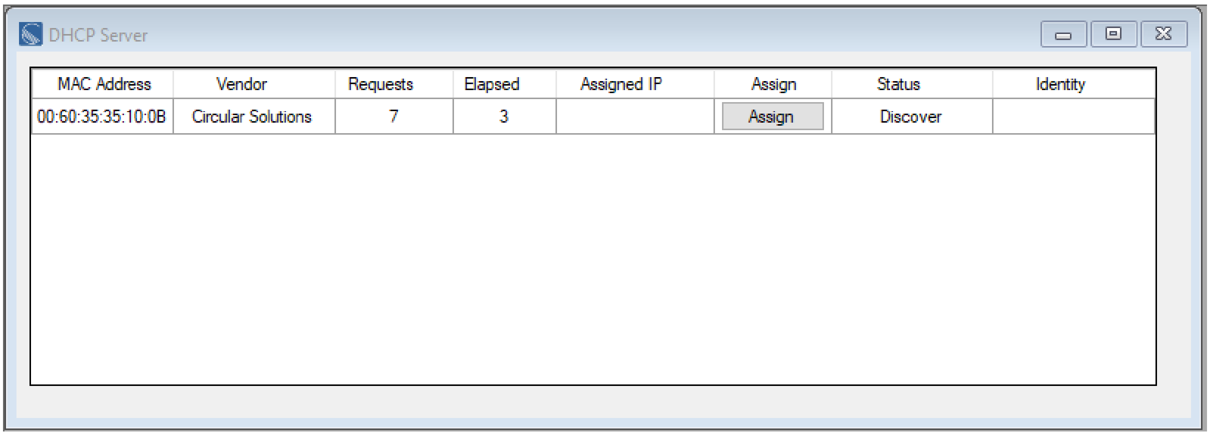

Figure 3.3. - DHCP Server

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.

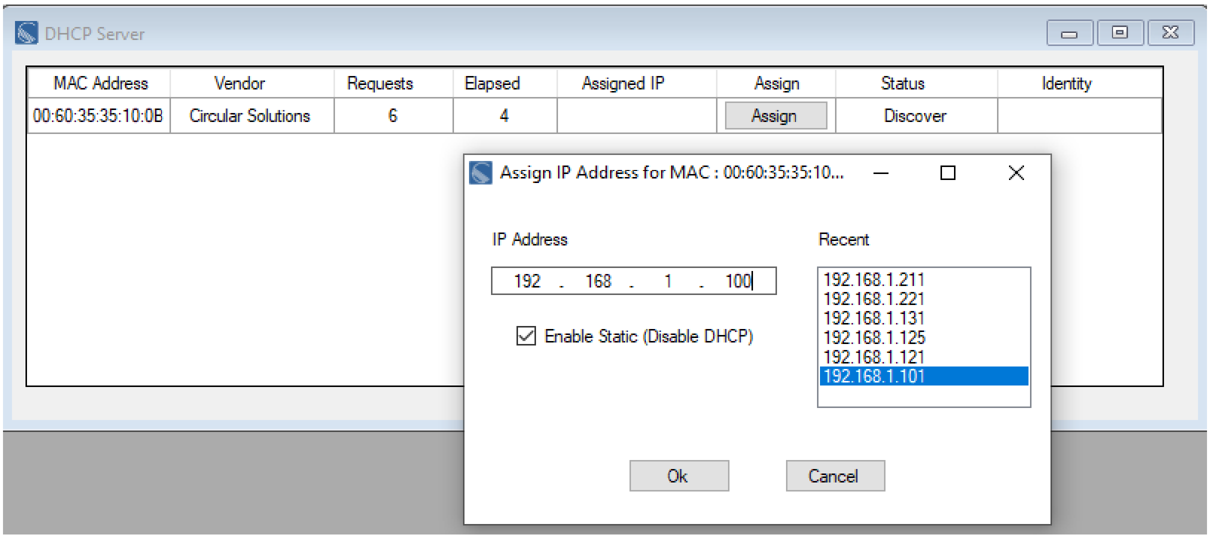

Figure 3.4. - Assigning IP Address

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.

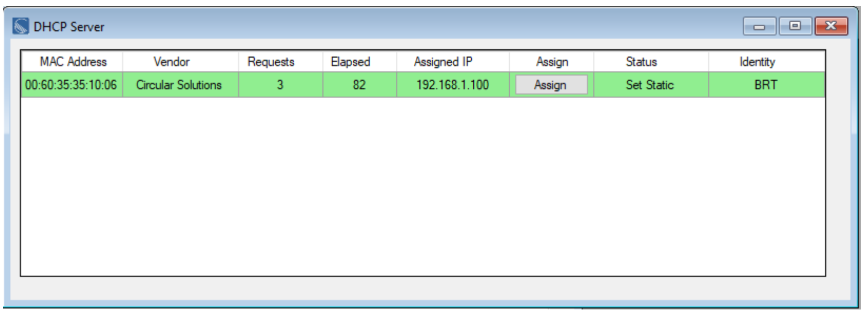

Figure 3.5. - Successful IP address assignment

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.

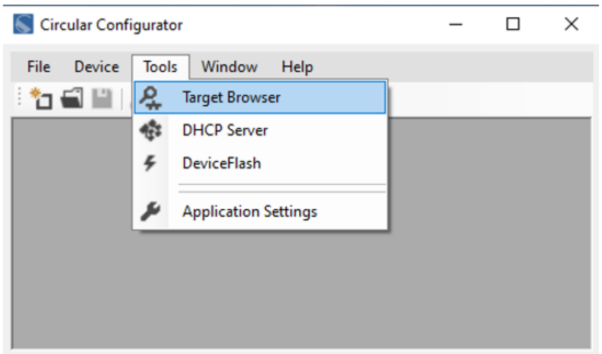

Figure 3.6. - Selecting the Target Browser

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

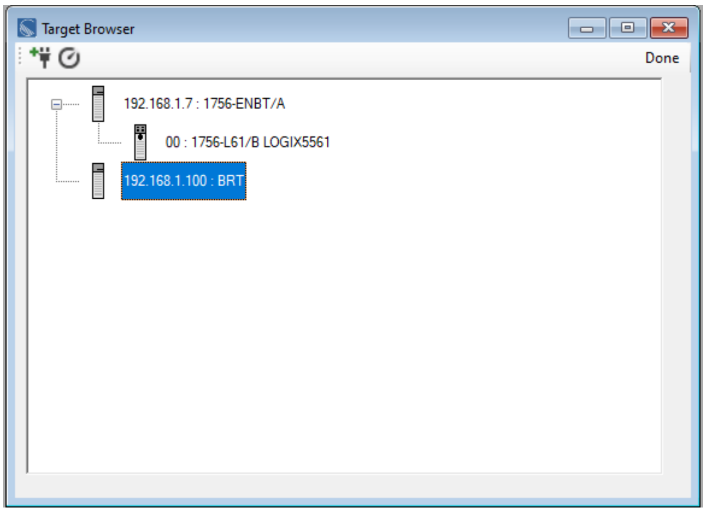

Figure 3.7. - Target Browser

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

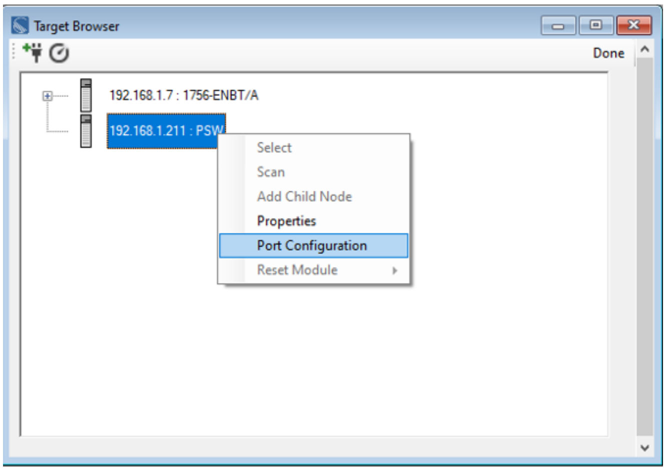

Figure 3.8. - Selecting Port Configuration

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

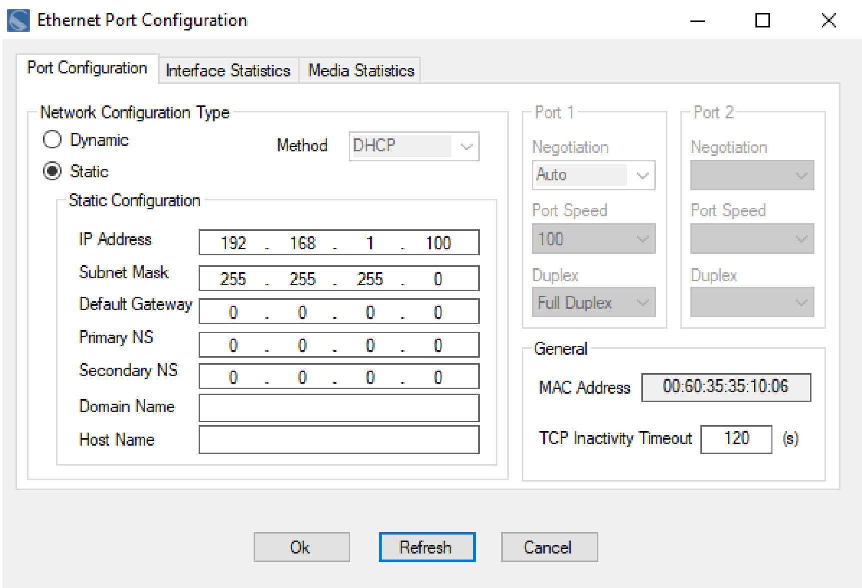

Figure 3.9. - Port Configuration

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

3.3. LOGIX INTEGRATION

The CS-BRT20 Belt Rip and Tear Detector can be easily integrated with Allen-Bradley Logix family of controllers.

3.3.1. ADD MODULE TO I/O CONFIGURATION

The Belt Rip and Tear Detector 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).

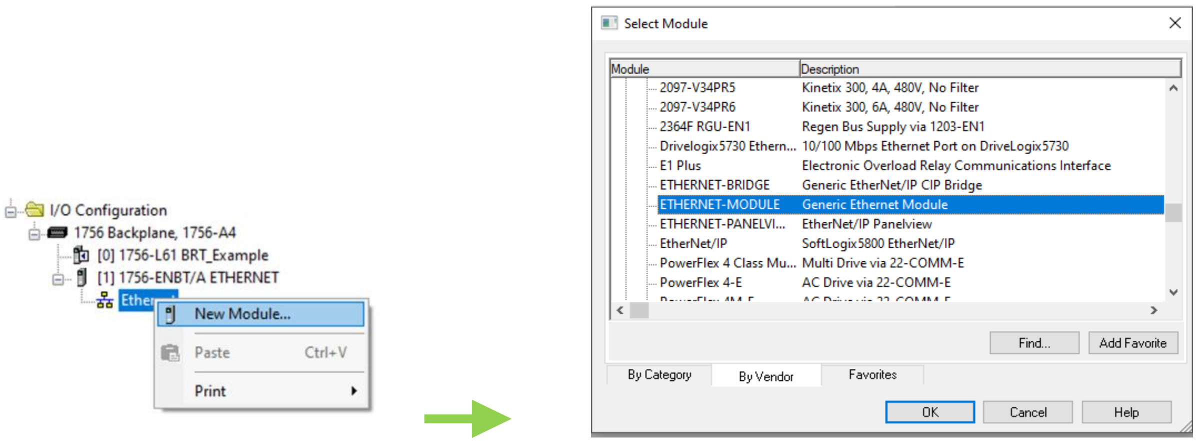

Figure 3.10 - Add a Generic Ethernet Module in RSLogix 5000

The user must enter the IP address of the Belt Rip and Tear Detector 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 Belt Rip and Tea Detector module are shown below:

Connection Parameter	*Assembly Instance*	*Size*
Input	163	100 (8-bit)
Output	164	20 (8-bit)
Configuration	102	0 (8-bit)

Table 3.1 - RSLogix class 1 connection parameters

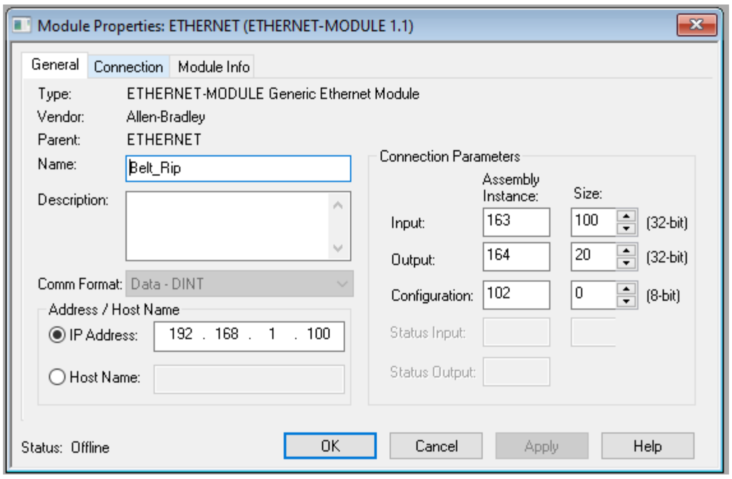

Figure 3.11 - RSLogix 5000 General module properties for Pre-start Warning

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.

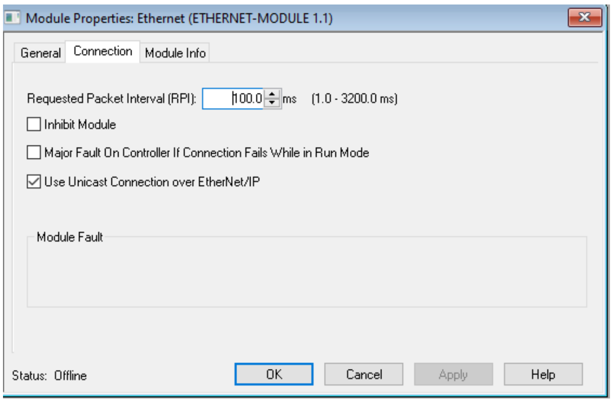

Figure 3.12 - Connection module properties in RSLogix 5000

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.

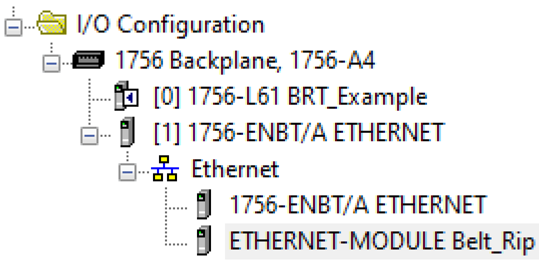

Figure 3.13 – RSLogix 5000 I/O module tree

4. LOGIX MAPPING

The Belt Rip and Tear 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 Belt Rip and Tear module.

Parameter	Datatype	Description
Instance	STRING	The instance name of the module that was configured under the general Belt Rip and Tear module configuration in Circular Configurator.
Input		
General Status	BOOL	Bit 0 - Class 1 owned Bit 1 - Modbus comms OK Bit 2 - Sensor Beam Healthy Bit 3 - Trip Bit 4 – Fault Bit 5 – Beam Test Fail Bit 6 – Reset Button Tamper Bit 7 – Reset Button Bit 8 – Beam Self-Test Enabled
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)
CurrentDO0	REAL	Current consumption of Sensor Healthy LED (mA)
CurrentDO1	REAL	Current consumption of Trip/Fault LED (mA)
CurrentDO2	REAL	Current consumption of DO2 (Emitter Gate) (mA)
CurrentDO0On	REAL	Last On Current consumption of Sensor Healthy LED (mA)
CurrentDO1On	REAL	Last On Current consumption of Trip/Fault LED (mA)
CurrentDO2On	REAL	Last On Current consumption of DO2 (Emitter Gate) (mA)
Beam Unhealthy Counter	DINT	Beam Unhealthy Fault Counter
Trip Counter	DINT	Trip Counter
Fault Counter	DINT	Fault Current Fault Counter
Reset Counter	DINT	Reset Button Counter
Beam Self-Test Counter	DINT	Beam Self-Test Counter
ResetStatsCommand Readback	DINT	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		
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 Belt Rip and Tear 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 Bit 0 - Class 1 owned Bit 1 - Modbus comms OK Bit 2 – Sensor Beam Healthy Bit 3 - Trip Bit 4 - Fault Bit 5 - BeamTestFail Bit 6 - Tamper Bit 7 – ResetButton Bit 8 – Beam Self-Test Enabled	0	INT BOOL BOOL BOOL BOOL BOOL BOOL BOOL BOOL BOOL	1 0 0 0 0 0 0 0 0 0	Reset button forced
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)
CurrentDO0 (mA)	18	INT	1	Current consumption of LED 1
CurrentDO1 (mA)	19	INT	1	Current consumption of LED 2
CurrentDO2 (mA)	20	INT	1	Current consumption of Siren
CurrentDO0On	21	INT	1	Last On Current consumption of DO0
CurrentDO1On	22	INT	1	Last On Current consumption of DO1
CurrentDO2On	23	INT	1	Last On Current consumption of DO2
Beam Unhealthy Counter	24	INT	1	Beam Unhealthy Counter
Trip Counter	25	INT	1	Trip Counter
Fault Counter	26	INT	1	Fault Counter
Reset Counter	27	INT	1	Reset Counter
Beam Self-Test Counter	28	INT	1	Beam Self-Test Counter
ResetStatsCommand Readback	29	INT	1	Echo of reset Command
Reserved	30	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 OK	BOOL	1
DI	2	General Status - Bit 2 – Sensor Beam Healthy	BOOL	1
DI	3	General Status - Bit 3 - Trip	BOOL	1
DI	4	General Status - Bit 4 - Fault	BOOL	1
DI	5	General Status - Bit 5 – BeamTestFail	BOOL	1
DI	6	General Status - Bit 6 – Reset Tamper	BOOL	1
DI	7	General Status - Bit 7 – Reset Button	BOOL	1
DI	8	General Status - Bit 7 – Beam Self-Test Enabled	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	ResetStatsCommand	INT	1	Transition from 0-1 triggers reset status
HR	101	R/W	Reserved	INT	1	
HR	102	R/W	Reserved	INT	1	
HR	103	R/W	Reserved	INT	1	

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.

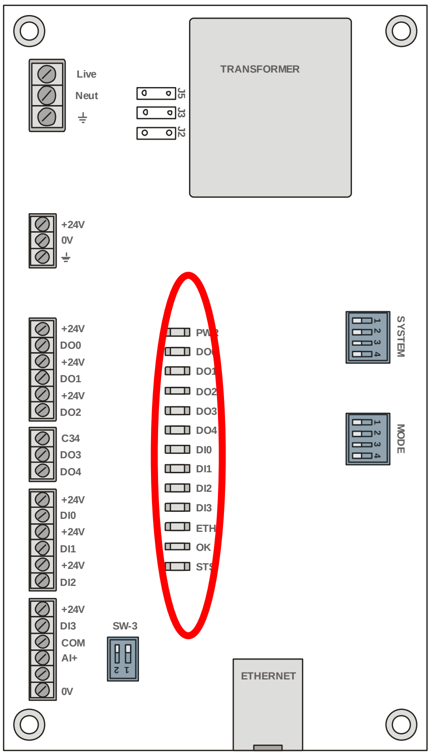

Figure 6.1 - Module Diagnostic LEDs

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 Sensor Healthy LED. LED is Green when output is on.
DO1	Green	Digital Output – used to power Trip/Fault LED. LED is Green when output is on.
DO2	Green	Digital Output – used to for the Emitter Gate. LED is Green when output is on.
DO3	Green	Digital Output – Trip output to PLC or control circuit. Used to trip conveyor

		belt for belt rip condition. N/O or N/C status selected in Mode DIP switch settings. LED is Green when output is on. Latching output – resets by Reset pushbutton or via communications.
DO4	Green	Digital output –Fault output to PLC. Triggers for device fault, sensor beam failure or Reset forced conditions. LED is Green when output is on. Latching output – resets by Reset pushbutton or via communications.
DI0	Green	Digital Input – Receiver sensor input. On when beam is received from emitter (signal healthy). LED is Green when input is on.
DI1	Green	Digital Input – Reset pushbutton. LED is Green when input is on.
DI2	Green	Digital Input – Spare
DI3	Green	Digital Input – Spare
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. ENCLOSURE DETAILS

Specification	Rating	
Dimensions	**Control Unit** Height 260mm Width 180mm Depth 100mm	**Emitter & Receiver Units** Length 205mm Height 120mm Depth 100mm
Material	Polycarbonate	
Impact Rating	IK10	
Enclosure IP Rating	IP66	

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. SENSORS

Specification	Rating
Power requirements	Voltage: 10-30V DC Current 30mA (Maximum)
Power consumption	0.7 W (Maximum)
Housing	IP67
Sensing Range	Up to 16m Response Time < 1ms
Temperature	-20 to 70 °C

Table 7.3 - Sensor specification

7.4. 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 7.4 - Ethernet specification

7.5. 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 7.5 - Digital Input specification

7.6. 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 7.6 - Relay Output specification