ELECTICAL EQUIPMENT

• CONVEYOR FIELDBUS SYSTEM-AUSTDAC

• Dupline Fieldbus User´s Manual 76-041-12

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USER'S MANUAL

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Dupline® is the registered trade mark of Carlo Gavazzi Industri Italy.
The zener barrier type Z960 is a product manufactured by Pepperl and Fuchs Germany.

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1. GENERAL DESCRIPTION

Dupline is a two wire multiplexing system or Fieldbus capable of sending and receiving up to 128 independent signals simultaneously in any direction over distances up to 10,000 metres. Communications on the Dupline signal pair can be either inbound from the field device to the channel generator for monitoring or outbound from the channel generator to the field device for control. The channel generator generally allows for 128 channels but some can be configured for 64, 32 or 16 channels allowing for faster update times. The channel generator produces a square wave signal on the Dupline pair that may be read and modified by the field devices to allow two- way communications. Amplitude modulation is used for inbound communications while pulse width modulation is used for outbound communications.
Some Austdac Dupline based conveyor control systems use three wire networks to improve transmission distance and fault tolerance of the emergency stop and remote isolate features of the system. The difference between two and three wire systems is described later in this manual.

Dupline hardware may be broadly assigned into one of the following classes:

- Transmitters, devices that accept field signals from any sensing device and allow the field data to be sent across the Dupline network.
- Receivers, devices that deliver control signals from the Dupline network to field actuating devices.
- Channel generators, devices that provide synchronization among transmitters and receivers as well as acting as a gateway to other Fieldbuses and control systems.

2. TYPICAL SYSTEM LAYOUT

The following diagram shows the typical layout of a Dupline system consisting of the channel generator, transmitters, receivers and the network cable.

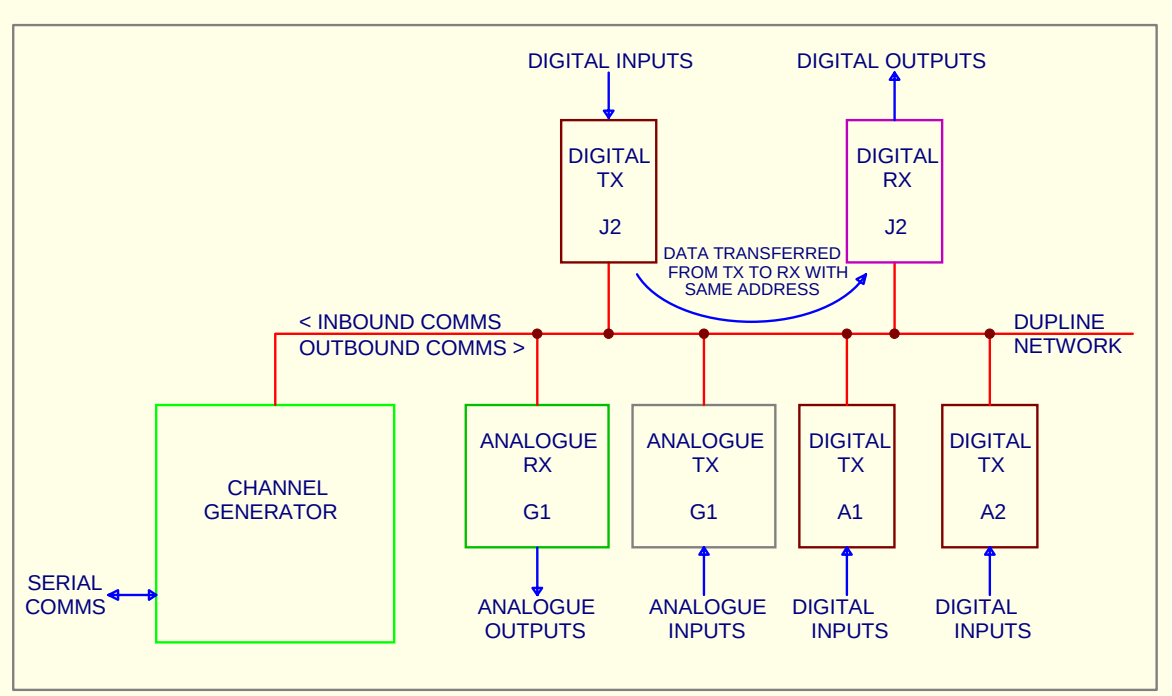


Figure 1. Typical system layout

3. NETWORK COMMUNICATION

The basis of data transmission along the Dupline twisted pair is that of pulse-width-modulation for outbound communications and amplitude modulation for inbound communications. The channel generator continuously maintains an offset square wave of 1 kHz frequency (i.e.: 1 ms period), each pulse representing one of the channels. The number of pulses and therefore the number of channels can be configured in the channel generator. The typical number of channels is 8, 16, 32, 64 or 128. This discussion now only deals with 128 channel systems, as these are the most common.

DUPLINE SYSTEM SIZE, ADDRESS RANGE AND UPDATE TIMES							
Number of Channels	First Address	Last Address	Sync Pulse	Scan Time	Worst Case Update Time		
					1D	2D	3D
8	A1	A8	8mS	16mS	32mS	48mS	64mS
16	A1	B8	8mS	24mS	48mS	72mS	96mS
32	A1	D8	8mS	40mS	80mS	120mS	160mS
64	A1	H8	8mS	72mS	144mS	216mS	288mS
128	A1	H8	8mS	136mS	272mS	408mS	544mS

Table 1 Table 1. Relationship between number of channels, address range and total scan time.

The channel generator emits the 128 channels regardless of whether or not the channels have been assigned to an I/O device. At the end of 128 pulses the channel generator sends an 8 ms wide pulse that resets all of the counters in the field devices back to zero, before the pulse train is repeated. The 8 ms wide pulse or synchronisation pulse is used to ensure that all field devices are kept in synchronisation ensuring that transmitters transmit on the correct channel and receivers sample the pulse train at the correct time. All field devices simply count the pulses or channels until the count matches their assigned address before transmitting or receiving.

The channels or addresses used in Dupline are labelled using a combination of alpha and numeric characters to make the assigning of addresses a little more easy and meaningful. In a 128 channel system the first channel is assigned the address A1, the last P8. Each alpha character covers a range of eight channels thus: A1, A2, A3, A4, A5, A6, A7 and A8 followed by B1 to B8 and so on.

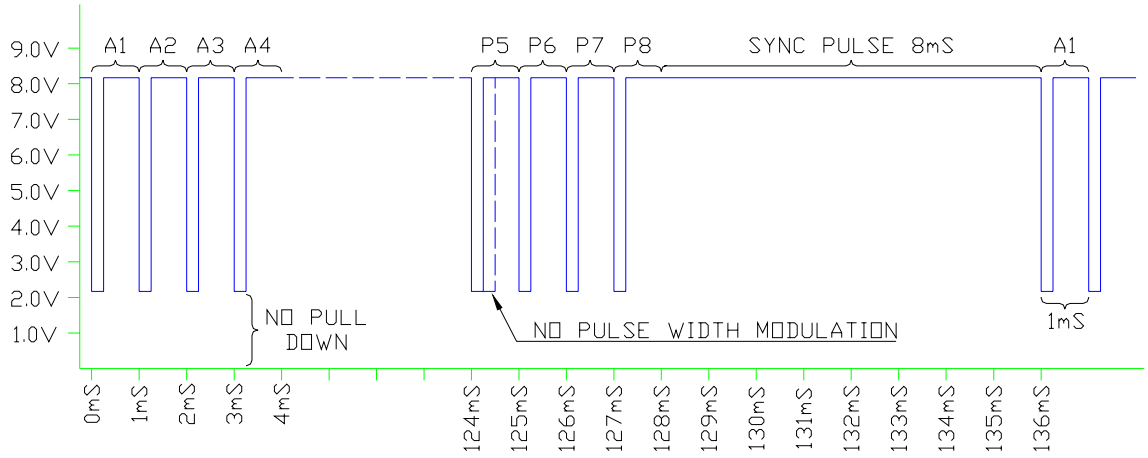


Figure 2. 128 Channel Dupline Pulse Train

Communications on the Dupline twisted pair is bi-directional using amplitude modulation for inbound signals from transmitters and pulse width modulation for outbound signals to receivers. In distributed I/O systems not all communications are from the field to the controller or vice versa, communications can be from field device to field device. Dupline has a unique feature of coupling the inbound to the outbound communications allowing multiple receivers to sample or eavesdrop on the one transmitter device, thus providing true distributed I/O. The channel generator sampling the inbound amplitude modulation and immediately altering the outbound pulse width modulation to reflect the state of the inbound channel achieves this coupling.

In some applications the inbound and outbound communication can be un-coupled and is referred to split I/O. Split I/O greatly increases the number of channels available.

Figure 2 shows a typical Dupline pulse train with no transmitters transmitting and no active channels being transmitted by the channel generator to any field receivers. The two important things to note about this waveform are firstly the absence of any amplitude modulation at the bottom of negative going pulses and secondly there is a constant space to mark ratio of 1:3, indicating no active output channels.

A non-active outbound channel is represented by the low portion of the pulse being one unit or 250 uS wide and the high portion of the pulse being three units or 750 uS wide making up the total period for the pulse of 1 mS. A non-active inbound channel is shown by the bottom of the low section of the pulse not going below 2.2 volts. The synchronisation pulse is also clearly visible at 8 mS wide.

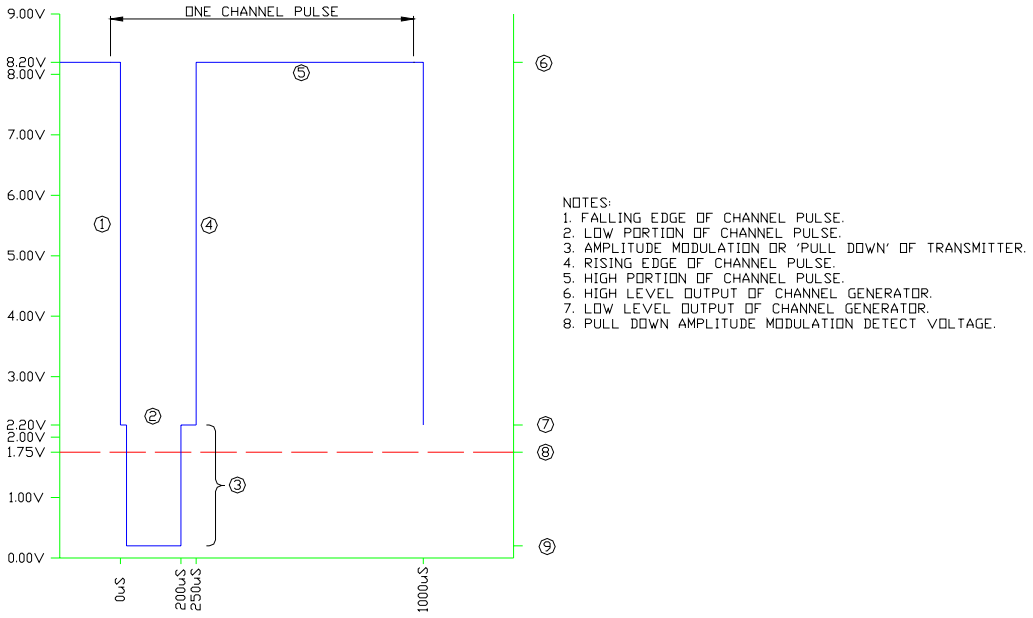


Figure 3. Active Amplitude Modulated Inbound Communications

Figure 3 shows an active inbound channel that has been amplitude modulated or “pulled down” by an active field transmitter. For the pull down to be recognised by the channel generator it must go below 1.75 volts and occur within the first 200 uS of the low portion of the channel pulse. All transmitter and receivers advance their internal counter on the negative edge of a channel pulse to be ready, if required, to transmit or receive. A small delay sometimes occurs between the negative edge put by the channel generator and the final pull down by the active transmitter. The updating of the counter causes this delay. Note that the transmitter does not alter the mark space ratio of the channel pulse, the channel generator does this after detecting a valid “pull down”.

Once a valid pull down has been detected, the channel generator will delay the rising edge of the channel pulse by an additional 250 uS, making the mark space ratio 1:1. It is this additional delay to the rising edge of the channel pulse that the appropriately coded receiver detects and acts upon. Figure 4 shows a channel pulse that has been pulse width modulated in response to a valid pull down or transmission from an active transmitter.

Because the pulse train and modulation is present along the entire length of the Dupline twisted pair then receivers can be placed at any convenient point to monitor a channel for local output. In fact many receivers can monitor the same channel or transmitter. This feature makes Dupline ideal for “distributed” or “de-centralized” I/O applications.

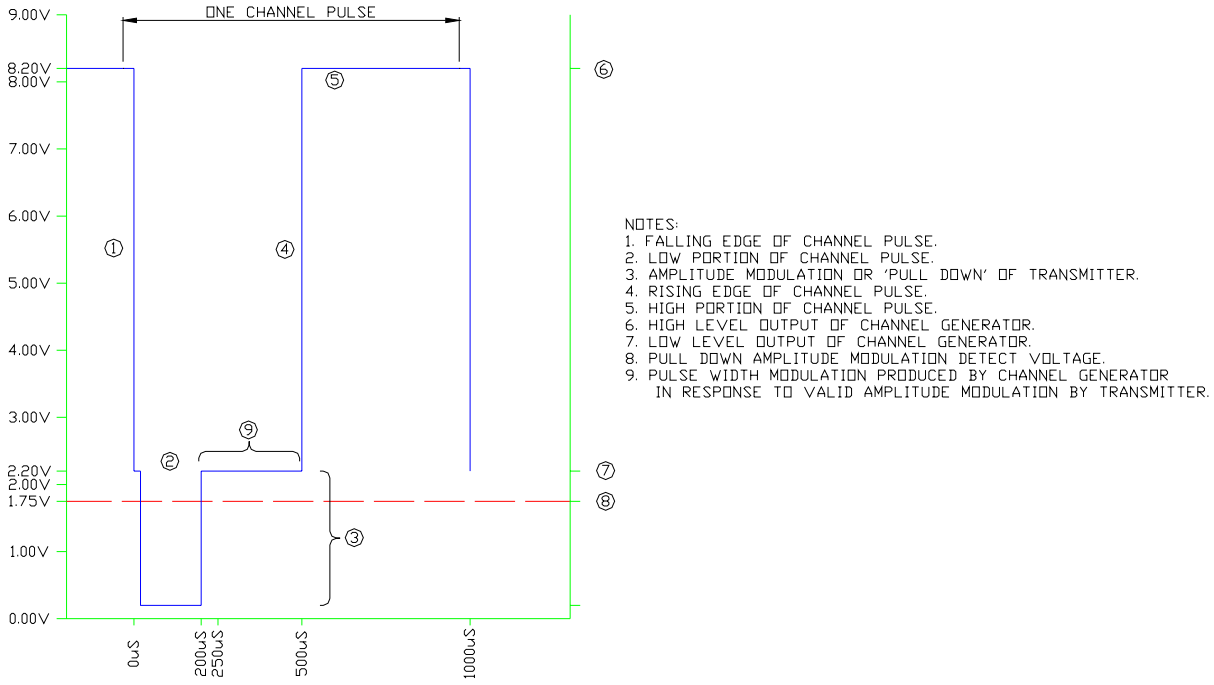


Figure 4. Active Pulse Width Modulated Outbound Communications

4. ANALOGUE TRANSMISSION (ANALINK)

Dupline is essentially a serial digital transmission network used for the monitoring and control of binary type sensors such as switches and contacts. Any individual digital channel may be further multiplexed to allow the transmission of analogue signals. This further multiplexing of digital channels for analogue transmission is referred to as the Analink transmission protocol. Any channel may be used for Analink analogue transmission.

As with most transmission systems the analogue quantity is first converted to a digital value which in turn is sent over the digital network. The Dupline network sends the digital value representing the analogue quantity as a serial bit stream in consecutive scans of the network. The Analink protocol allows for eight-bit resolution in the conversion of analogue quantities.

A full scale analink value takes 256 Dupline scans to transmit with the channel on for all the scans, a zero scale analink value takes 256 Dupline scans to transmit with the channel on for one of the scans and off for 255 scans. An Analink channel with all 256 scans off is transmitting a fault signal i.e. a sensor fault.

The transmitted value is equal to the proportion of “on” scans minus one in any consecutive group of 256 scans. Therefore the transmitted value = “on scans - 1” / 256.

The analink transmission protocol does not use any synchronising signal; it relies on the number of on channels in any 256 consecutive scans.

Analink analogue transmission should NOT be used on systems that have channel generators set to 2D or 3D.

5. SPLIT I/O

Split I/O is a configurable feature of some channel generators where the inbound communications from a transmitter to the channel generator is not coupled to outbound communications from the channel generator to a receiver. Split I/O is used in larger systems where all communications is via a master control device e.g. PLC. Split I/O is not used in Austdac conveyor control systems.

6. 1D, 2D AND 3D TRANSMISSION SYSTEMS

The default configuration of a typical channel generator is the '1D' or normal system configuration. This causes the channel generator to alter the outbound pulse width modulation immediately after receiving the inbound amplitude modulation. 1D configuration ensures that a change of state from a transmitter is immediately sent to all receivers of the same address.

The 2D configuration requires two consecutive scans from a transmitter to be the same before the outbound transmission is altered to the receiver on the same address. Similarly the 3D configuration requires three consecutive scans from a transmitter to be the same before the outbound transmission is altered to the receiver on the same address.

2D and 3D systems are used when extremely high noise immunity is required in particularly noisy environments. Analink analogue transmission should NOT be used on systems that have channel generators set to 2D or 3D.

7. THE EXPLOSION PROTECTED DUPLINE SYSTEM

The explosion protected Dupline system consists of many modules that may be connected together to provide solutions for various applications in underground coalmines and general group I hazardous areas. The system consists of controllers or channel generators, input / output modules, repeaters and other system related modules. Some I/O modules are line powered from the Dupline network while others are powered from external power supplies. All externally powered modules are opto-isolated from the Dupline network to simplify intrinsically safe multiple power supply considerations and entity concept assessments.

Table 2 below shows the current range of modules by name and type number.

THE Ex DUPLINE PRODUCT RANGE (AUS Ex 3480X)				
#	DEVICE NAME	TYPE	MAX UNITS ON THE SYSTEM	POWER
1	BELT CONTROLLER	8081	1	24, 110 or 240V AC
2	CHANNEL GENERATOR	DEX 3490 000 712	1	12V DC Ex ia
3	1 CH DIGITAL TRANSMITTER	8023	128	LINE POWERED
4	8 CH DIGITAL TRANSMITTER	8084	16-128	LINE POWERED
5	4 CH DIGITAL RECEIVER	ARX4D	16	EXTERNAL POWER
6	1 CH ANALOGUE TRANSMITTER	G3210 1161	112	LINE POWERED
7	4 CH ANALOGUE TRANSMITTER	ATX4A		EXTERNAL POWER
8	8 CH ANALOGUE RECEIVER	ARX8A	14	EXTERNAL POWER
9	1 CH TEMPERATURE TRANSMITTER	G3210 1112	112	LINE POWERED
10	ZENER LIMITER	AEL1	1	LINE POWERED
11	BARRIER	Z960	1	LINE POWERED
12	TERMINATION UNIT	DT01	8	LINE POWERED
13	TEST UNIT	GTU8	2	LINE POWERED
14	PROGRAMMER	GAP1605	NIL	BATTERY
15	REPEATER	A2WCCT1		EXTERNAL POWER
16	2 AND 3 WIRE NETWORK CABLE	-	8000m	-
17	1 CH DIGITAL TRANSMITTER	SILBUS8161	128	LINE POWERED
18	8 CH DIGITAL TRANSMITTER	SILBUS8163	16-128	LINE POWERED
19	1 CH SAFETY TRANSMITTER	SILBUS8150	63	LINE POWERED
20	CHANNEL GENERATOR	GSW1-AC	1	24V AC
21	CHANNEL GENERATOR	GSW1-DC	1	12V DC Ex ia

Table 2 The Ex Dupline Product Range

Only modules listed in table 2 above form part of the explosion protected Dupline system and therefore only these modules may be connected to a Dupline network located in or partially located within a hazardous area. Austdac drawing 76-001-19 shows the alternative ways in which the system may be configured.

Where a barrier type Z960 and zener limiter type AEL1 are used to extend the Dupline network out of the hazardous area into the safe area, any Dupline product from the Dupline catalogue may be connected to the safe area portion of the network without compromising the explosion protection properties of the hazardous area portion of the network.

8. CHANNEL GENERATOR 8081

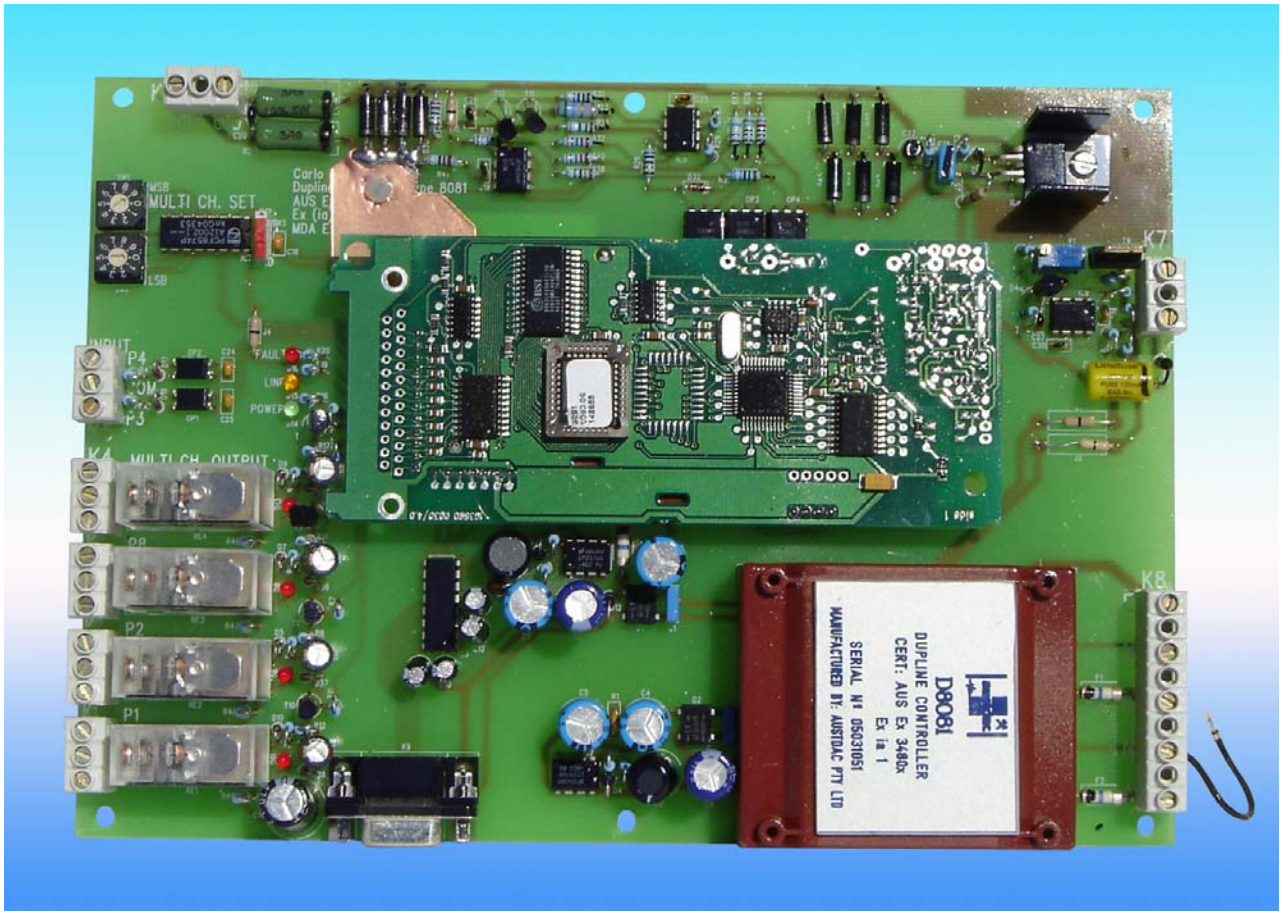
The type 8081 channel generator or main controller is responsible for producing the square wave pulse train that provides power to the field devices, the carrier for the two way digital communications and maintaining the synchronisation of all channels or addresses on the system. Only one channel generator may reside on a Dupline two-wire network. The channel generator is responsible for monitoring the amplitude modulation for inbound communications and producing the pulse width modulation for outbound communications.

The 8081 channel generator operates from a 24, 110 or 240 VAC 50 or 60 Hz supply.

The 8081 channel generator also has some added I/O features that make it particularly suitable as a main controller for a conveyor emergency stop and remote isolation system. These features include four (digital) relay outputs, two (digital) opto coupled inputs, a MODBUS serial interface and a choice of power supply input. One of the relay outputs is a multi-channel output that implements an ‘OR’ or ‘AND’ logic function using Dupline channels as terms in the logic functions. The number of channels used is selectable.

The 8081channel generator is a printed circuit board measuring 230mm x 160mm with a maximum height of 50mm. The I/O and power connections are distributed around the perimeter of the printed circuit board.

The channel generator type 8081 must be located in a safe area, it must NOT be located in a hazardous area.



Photograph 1. Channel Generator type 8081.

DIGITAL INPUTS

The 8081 has two opto-coupled digital inputs that may be used to control the Dupline channel addresses P3 and P4. These inputs accept switched 24VDC to be activated. Three terminals at K5 are provided for these inputs. The inputs will consume approximately 5mA at a nominal 24VDC. Only non-intrinsically safe circuits can be used to activate the digital inputs of the 8081.

8081 DIGITAL INPUTS		
TERMINAL		DUPLINE CHANNEL ADDRESS
K5 - 1	K5 - 2	P4
K5 - 3	K5 - 2	P3

Table 3. 8081 Digital Input Terminal and Address Allocations

The digital inputs are polarity sensitive and will not function if the inputs are wired incorrectly. Reverse wiring will not damage the 8081.

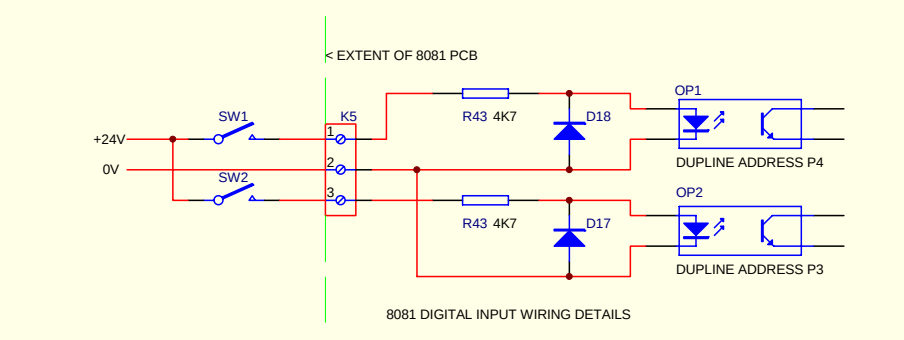


Figure 5. 8081 Digital Input Wiring Details

DIGITAL OUTPUTS

The 8081 channel generator is provided with four digital outputs in the form of relay changeover contact sets. These contact sets may be used to switch non-intrinsically safe circuits up to a maximum of 264VAC rms and 1 amp.

Each digital relay output has an LED mounted adjacent to each relay to indicate that the respective relay is energised. Refer to photograph 1 for the location of the digital output relays, output terminal blocks and indicating LEDs.

8081 DIGITAL OUTPUT CONNECTION DETAILS				
RELAY	BLOCK	PIN	FUNCTION	DUPLINE ADDRESS
RE1	K1	1	N/O	P1
		2	N/C	
		3	COM	
RE2	K2	1	N/O	P2
		2	N/C	
		3	COM	
RE3	K3	1	N/O	P8
		2	N/C	
		3	COM	
RE4	K4	1	N/O	MULTI-CHANNEL OUTPUT CONTROLLED BY LOGIC FUNCTION
		2	N/C	
		3	COM	

Table 4. 8081 DIGITAL OUTPUT CONNECTION DETAILS

Figure 6 below shows the relay output connection details in schematic format. It is important that all digital relay output wiring be segregated from any intrinsically safe circuits that may be connected to the type 8081 channel generator.

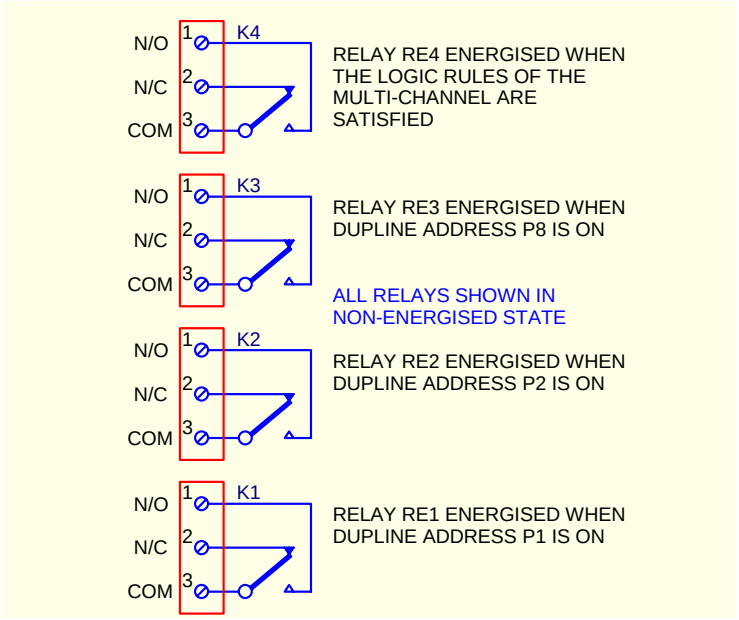


Figure 6. 8081 Digital Output Relay Connection Details

MULTI CHANNEL OUTPUT

The multi-channel relay output (relay RE4, terminal K4) implements one of two logic functions. The available logic functions or expressions are 'OR' and 'AND'. Switch SW3 is used to select between the 'OR' logic function and the 'AND' logic function. The selected logic functions are labelled adjacent to SW3. Switches SW1 and SW2 govern the number of terms or Dupline channel addresses included in the logic expression. The terms included in the logic expression always commence at Dupline address A1 and proceed in order up to the Dupline channel address specified by switches SW1 and SW2. The maximum number of terms that may be included in the logic expression is 99 or Dupline channel addresses A1 through L3. Switch SW1 is the most significant digit (tens) of the term count while SW2 is the least significant digit (units) of the term count.

SW1 AND SW2 LOGIC EXPRESSION TERM COUNT SETTING DETAILS (Examples)			
SW1	SW2	No. OF TERMS	DUPLINE ADDRESSES INCLUDED IN FUNCTION
0	5	5	A1, A2, A3, A4, A5, A6, A7 and A8
1	6	16	A1 through B8 inclusive
2	0	20	A1 through C4 inclusive
3	2	33	A1 through E1 inclusive
4	0	40	A1 through E8 inclusive
9	9	99	A1 through L3 inclusive

Table 5. SW1 and SW2 Logic Expression Term Count Setting Details

The 'AND' function requires that all specified terms or Dupline channel addresses must be ON or active for the multi-channel relay RE4 to be energised. The multi-channel relay will be de-energised if any one term or channel address is not active or ON. Similarly, the 'OR' function requires that only one of the specified terms or Dupline channel addresses must be ON or active for the multi-channel relay RE4 to be energised. The multi-channel relay will be de-energised if and only if all terms or channel addresses are not active or OFF.

DUPLINE NETWORK I/O

The Dupline network or signal pair should be connected to terminal block K6. Only one channel generator should be connected to the Dupline network. The Dupline network may be an intrinsically safe circuit and if so should be segregated from all non-intrinsically safe circuit.

DUPLINE NETWORK I/O CONNECTION DETAILS			
FUNCTION	TERMINAL BLOCK	PIN	NAME
SIGNAL	K6	1	DUP
COMMON		3	GND

Table 6. 8081 Dupline Network I/O Connection Details

EXTERNAL POWER

The Dupline network may be powered from a different power source to the internal power source of the 8081 channel generator. This option is provided to allow the Dupline network to be powered from the same power source as other intrinsically safe apparatus that may share a common multi-cored cable. If the external power source for the Dupline network is used then jumpers J1 and J2 must be completely removed from the 8081 printed circuit board. The external power is fed into the type 8081 channel generator via terminal block K7. The external power source shall be an intrinsically safe source with the appropriate entity parameters to drive the Dupline network.

EXTERNAL POWER CONNECTION DETAILS			
FUNCTION	TERMINAL BLOCK	PIN	NAME
POSITIVE	K7	3	Vex+
NEGATIVE		1	Vex-

Table 7. 8081 External Power Connection Details

Note that the mains input supply must still be connected to the 8081 to power the non-intrinsically safe section of the channel generator.

MAINS POWER INPUT

The channel generator type 8081 is powered from 120VAC or 240VAC, 50Hz or 60Hz. The mains power is connected to the 8081 via terminal block K8. The mains input consists of two 120V primaries of the input transformer. The primaries are wired in series for 240V operation and in parallel for 120V operation. Figure 7 below shows the wiring connections for the mains input.

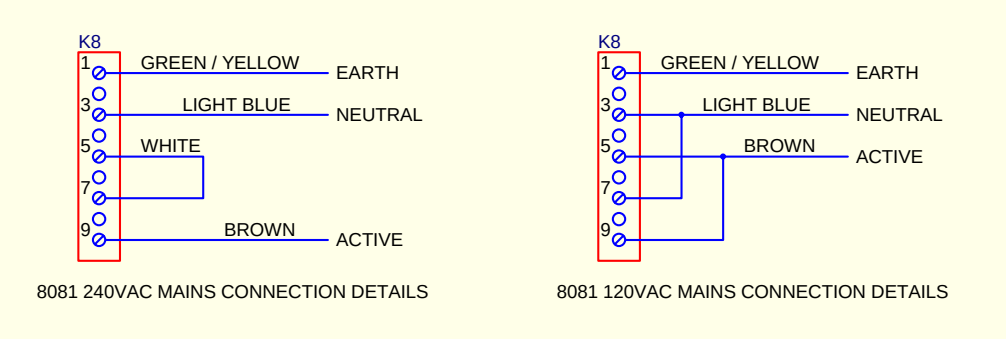


Figure 7. 8081 Mains Input Wiring and Connection Details

DIAGNOSTIC LED

The channel generator type 8081 is fitted with three diagnostic LEDs to allow the operation of the channel generator to be monitored. Table 8 below shows the function of the diagnostic LEDs.

8081 DIAGNOSTIC LED FUNCTION			
CCT REF	COLOUR	NAME	FUNCTION
LD1	GREEN	POWER	Indicates, when illuminated, that mains power is available
LD2	RED	FAULT	Indicates, when illuminated, that a fault has occurred.
LD3	ORANGE	LINE	Indicates, when illuminated, that the Dupline signal pair is normal i.e. no short circuit.

Table 8. 8081 Diagnostic LED Function Details

SERIAL PORT

The 8081 is provide with a serial RS232 port for communication with a PC or host PLC. This serial port allows the host controller access to the status of all Dupline channels and to control any Dupline channel. Connection to the serial port is via connector K9. Connector K9 is a female nine way ‘D’ type. Austdac drawing 76-245-08 provides wiring details for various interface cables for the 8081 serial interface. Table 9 below shows the function and Austdac part numbers for these cables.

8081 CHANNEL GENERATOR SERIAL PORT INTERFACE CABLE PART NUMBERS		
#	AUSTDAC P/No:	FUNCTION
1	DUPCAB02	8081 (9 PIN) TO PC (9 PIN) INTERFACE CABLE
2	DUPCAB03	8081 (9 PIN) TO AB PLC5/SLC5 (9PIN) INTERFACE CABLE

Table 9. 8081 Serial Port Interface Cable Details

The pin number and function details of the serial port connector K9 of the 8081 channel generator are shown in table 10 below.

8081 CHANNEL GENERATOR SERIAL PORT CONNECTOR PIN FUNCTION DETAILS				
PIN #	NAME	NEMONIC	8081 I/O DIRECTION	I/O VOLTAGE
1	TRANSMIT DATA	TXD	OUTPUT	+/- 9 VOLTS
2	RECEIVE DATA	RXD	INPUT	
3	NO CONNECTION	N.C.	-	
4	NO CONNECTION	N.C.	-	
5	GROUND	GND	-	
6	NO CONNECTION	N.C.	-	
7	REQUEST TO SEND	RTS	OUTPUT	
8	CLEAR TO SEND	CTS	INPUT	
9	NO CONNECTION	N.C.	-	

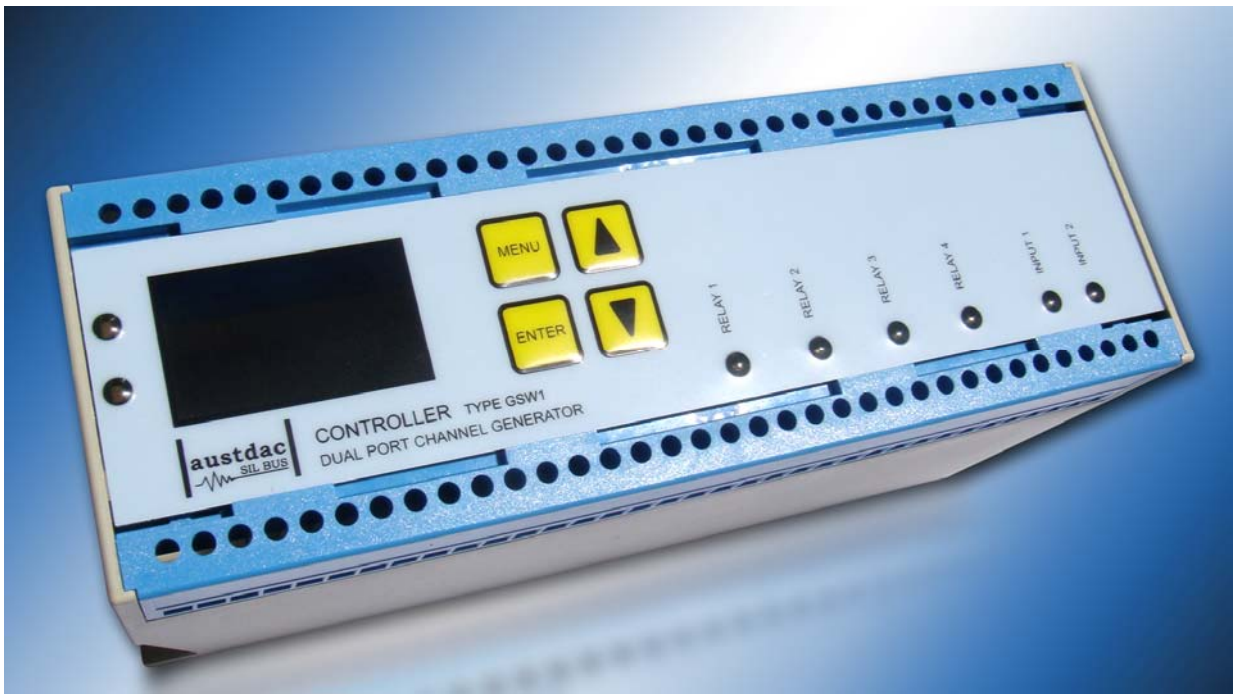
Table 10. 8081 Serial Port Interface Connector Pin Function Details

9. DUAL PORT CHANNEL GENERATOR TYPE GSW1

The dual port channel generator type GSW1 provides two Dupline networks ports that share a common database of 16, 32, 64 or 128 channels. This allows the line powered field devices to be distributed over two networks allowing greater field distances to be achieved, this is particularly useful in conveyor control systems that have walk-side and non walk-side lanyard cables.

Photograph 2. Channel generator type GSW1-AC (blue and black terminal blocks)

The dual port channel generator is housed in a DIN rail mounting plastic enclosure measuring 75mm (W) x 225mmv(L) x 110mmv(H). The front panel has a 64 x 128 pixel graphic display and four key keypad to control and configure the GSW1. Front panel light emitting diodes also show the status of the two local digital inputs and the four configurable relay outputs.



Photograph 3. Channel generator type GSW1-DC (two blue terminal blocks)

DUAL PORT CHANNEL GENERATOR TYPE GSW1-AC CONNECTION DETAILS		
TERMINAL	NAME	FUNCTION
TB1	SIG 1	ISOLATED GSW1 PORT 1 OUTPUT SILBUS NETWORK 1
TB2	COM 1	
TB34	SIG 2	ISOLATED GSW1 PORT 2 OUTPUT SILBUS NETWORK 2
TB35	SIG 2	
TB36	24V AC	POWER SUPPLY INPUT NOMINAL 24V AC
TB37	24V AC	
TB39	EARTH	SAFETY EARTH TERMINATION POINT
TB40	EARTH	
TB49	TX/RX+	MODBUS RS485 COMMUNICATIONS PORT
TB50	TX/RX-	
TB51	SCREEN	
TB53	COM 1	CONFIGURABLE RELAY OUTPUT 1
TB54	N/C 1	
TB55	N/O 1	
TB56	COM 2	CONFIGURABLE RELAY OUTPUT 2
TB57	N/C 2	
TB58	N/O 2	
TB59	COM 3	CONFIGURABLE RELAY OUTPUT 3
TB60	N/C 3	
TB61	N/O 3	
TB62	COM 4	CONFIGURABLE RELAY OUTPUT 4
TB63	N/C 4	
TB64	N/O 4	
TB65	+24F	+24V DC FIELD SUPPLY OUTPUT
TB66	I/P 1	ISOLATED DIGITAL INPUT 1
TB67	I/P 1	
TB68	I/P 2	ISOLATED DIGITAL INPUT 2
TB69	I/P 2	
TB70	0VF	0V DC FIELD SUPPLY OUTPUT

Table 11. Dual port channel generator type GSW1-AC connection details

The GSW1 is provided with two isolated local digital inputs that can be configured to transmit on any valid Dupline channel. These local inputs are useful for conveyor sequencing when the GSW1 is employed in a

conveyor control system. The addresses of these inputs are configured via the front panel display and keyboard.

The dual port channel generator type GSW1 is available in two basic versions the type GSW1-AC and the type GSW1-DC. The GSW1-AC is powered from 24 volts AC 50Hz and is designed as associated apparatus to be mounted in the safe area. The GSW1-DC is powered from a 12 volt DC Ex ia or Ex ib power supply. The two SILBUS network ports are galvanically isolated from each other while the two network ports of the GSW1-DC are electrically connected together.

Up to four configurable relay outputs are also provided for local output of application defined functions. These outputs can be configured as “NORMAL”, “INVERT”, “AND”, “OR”, “NAND” or “NOR” logic functions with from one to 64 input terms. These outputs are configured via the front panel mounted display and keyboard.

DUAL PORT CHANNEL GENERATOR TYPE GSW1-DC CONNECTION DETAILS		
TERMINAL	NAME	FUNCTION
TB1	SIG 1	GSW1 PORT 1 OUTPUT SILBUS NETWORK 1
TB2	COM 1	
TB34	SIG 2	GSW1 PORT 2 OUTPUT SILBUS NETWORK 2
TB35	SIG 2	
TB36	24V AC	POWER SUPPLY INPUT NOMINAL 12V DC Ex ia
TB37	24V AC	
TB39	EARTH	SAFETY EARTH TERMINATION POINT
TB40	EARTH	
TB49	TX/RX+	MODBUS RS485 COMMUNICATIONS PORT
TB50	TX/RX-	
TB51	SCREEN	
TB53	COM 1	CONFIGURABLE RELAY OUTPUT 1
TB54	N/C 1	
TB55	N/O 1	
TB56	COM 2	CONFIGURABLE RELAY OUTPUT 2
TB57	N/C 2	
TB58	N/O 2	
TB59	COM 3	CONFIGURABLE RELAY OUTPUT 3
TB60	N/C 3	
TB61	N/O 3	
TB62	COM 4	CONFIGURABLE RELAY OUTPUT 4
TB63	N/C 4	
TB64	N/O 4	
TB65	+VF	+8V TO 12V DC FIELD SUPPLY OUTPUT
TB66	I/P 1	ISOLATED DIGITAL INPUT 1
TB67	I/P 1	
TB68	I/P 2	ISOLATED DIGITAL INPUT 2
TB69	I/P 2	
TB70	0VF	0V DC FIELD SUPPLY OUTPUT

Table 12. Dual port channel generator type GSW1-DC connection details

The GSW1 is provided with a half duplex RS485 MODBUS RTU communications port with an enhanced database features that provides normal digital, safety digital, analink and fastlink data on each channel in the Dupline network database.

For more detail refer to a separate manual 120-023-12 on the channel generator type GSW1.

10. ZENER LIMITER TYPE AEL1

The zener limiter type AEL1 is a simple two zener diode voltage limiter built in a small DIN rail mounting enclosure with a maximum output voltage of 8.65 volts. The zener limiter is used to limit the maximum voltage that may be applied to the Dupline network by a channel generator type DEX3490 000 712 or barrier type Z960. The zener limiter must be placed between the Dupline network and a channel generator type DEX3490 000 712 or barrier type Z960. The zener limiter is not required between a type 8081 channel generator and the Dupline network, unless a barrier type Z960 is installed onto the network, in which case the zener limiter must be placed between the Dupline network and both the barrier and the 8081 channel generator.

Photograph 4. Zener limiter type AEL1.

The connections details for the zener limiter type AEL1 is shown in table 13 below.

ZENER LIMITER TYPE AEL1			
TERMINAL BLOCK	CONNECTOR	PIN	FUNCTION
TB1	X1	1	DUPLINE INPUT COMMON
		2	DUPLINE INPUT SIGNAL
TB2	X2	3	LIMITED DUPLINE OUTPUT COMMON
		4	LIMITED DUPLINE OUTPUT SIGNAL

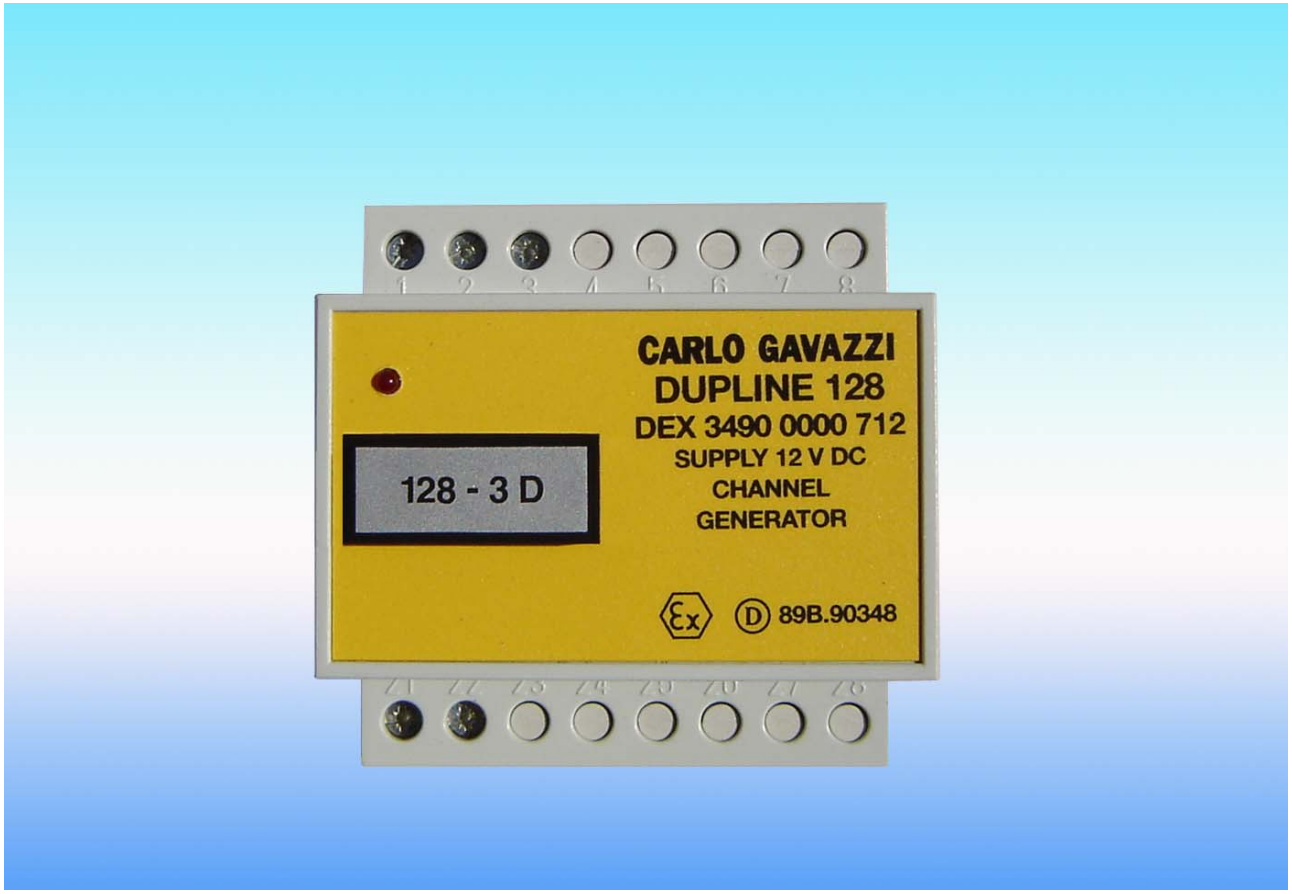
Table 13. Zener Limiter Type AEL1 Connection Details

11. CHANNEL GENERATOR DEX 3490 000 712

The type DEX 3490 000 712 channel generator is responsible for producing the square wave pulse train that provides power to the field devices, the carrier for the two way digital communications and maintaining the synchronisation of all channels or addresses on the system. Only one channel generator may reside on a Dupline two-wire network. The channel generator is responsible for monitoring the amplitude modulation for inbound communications and producing the pulse width modulation for outbound communications.

The DEX 3490 000 712 channel generator operates from a 12V DC power supply only. This power supply must be an intrinsically safe power supply.

The DEX 3490 000 712 channel generator is mounted within a small DIN rail mounting enclosure measuring 70mm(W) x 75mm(H) x 70mm(D). The front panel has a single red LED that is illuminated to indicate that the Dupline two wire network has a short circuit. A socket is also provided on the front panel to allow a code module type FMK to be fitted. The FMK code module is used to select the maximum number of Dupline channels. The DEX 3490 000 712 channel generator can be configured with the FMK module to have 8, 16, 32, 64 or 128 channels.



Photograph 5. Channel Generator Type DEX 3490 000 712 and code module type FMK.

The connection or wiring details of the channel generator Type DEX 3490 000 712 are shown in table 14 below.

CHANNEL GENERATOR TYPE DEX 3490 000 712 CONNECTION DETAILS	
PIN	FUNCTION
1	DUPLINE SIGNAL OUTPUT
2	DUPLINE COMMON OUTPUT
3	CHANNEL GENERATOR STOP INPUT (O/C = RUN, PIN2 CONNECTED TO PIN3 = STOP)
21	+12 V DC POWER INPUT
22	-12V DC POWER INPUT

Table 14. Channel Generator Type DEX 3490 000 712 Connection Details

12. ZENER BARRIER TYPE Z960

The zener barrier type Z960 is only used to allow the connection of a safe area Dupline network to the explosion protected Dupline network in the hazardous area. The Z960 must be located in the safe area immediately outside the hazardous area. The safe area terminals of the Z960 must be connected to the two wire Dupline network located in the safe area. The hazardous area terminals of the Z960 must be connected to two wire Dupline network located within the hazardous area.

The zener barrier type Z960 is a DIN rail mounting barrier that allows circuits of the safe area to be through connected to the circuits of the hazardous area. The barrier achieves this by limiting both the voltage and current delivered to the hazardous area. This limitation can only be accomplished if the DIN rail upon which the barrier is mounted and terminals 2 and 3 are separately connected to a protective earth. It is imperative that the integrity of these earth connections is maintained at all times.

The wiring connected to each side of the zener barrier type Z960 must be segregated to ensure that dangerous voltages or currents cannot bypass the barrier. The wiring shall be contained within trunking or ducting or physically restrained to ensure that a loose connection does not bridge the isolation provided by the Z960 barrier.

If a Z960 barrier is installed in a Dupline system that resides in both the safe area and the hazardous area, a zener limiter type AEL1 must be installed between the hazardous area terminals of the Z960 and the two wire Dupline network in the hazardous area. See Austdac drawing 76-001-19 sheet 01of 05 for the correct wiring details of the Z960 barrier.

ZENER BARRIER TYPE Z960 CONNECTION DETAILS		
PIN #	AREA	FUNCTION
1	HAZARDOUS	DUPLINE SIGNAL
2	HAZARDOUS	PROTECTIVE EARTH
3	HAZARDOUS	PROTECTIVE EARTH
4	HAZARDOUS	DUPLINE COMMON
5	SAFE	DUPLINE COMMON
6	SAFE	PROTECTIVE EARTH
7	SAFE	PROTECTIVE EARTH
8	SAFE	DUPLINE SIGNAL

Table 15. Zener Barrier type Z960 Connection Details.

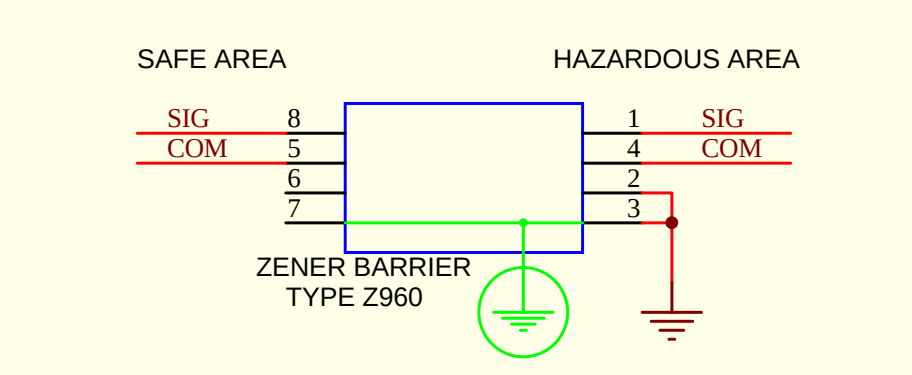
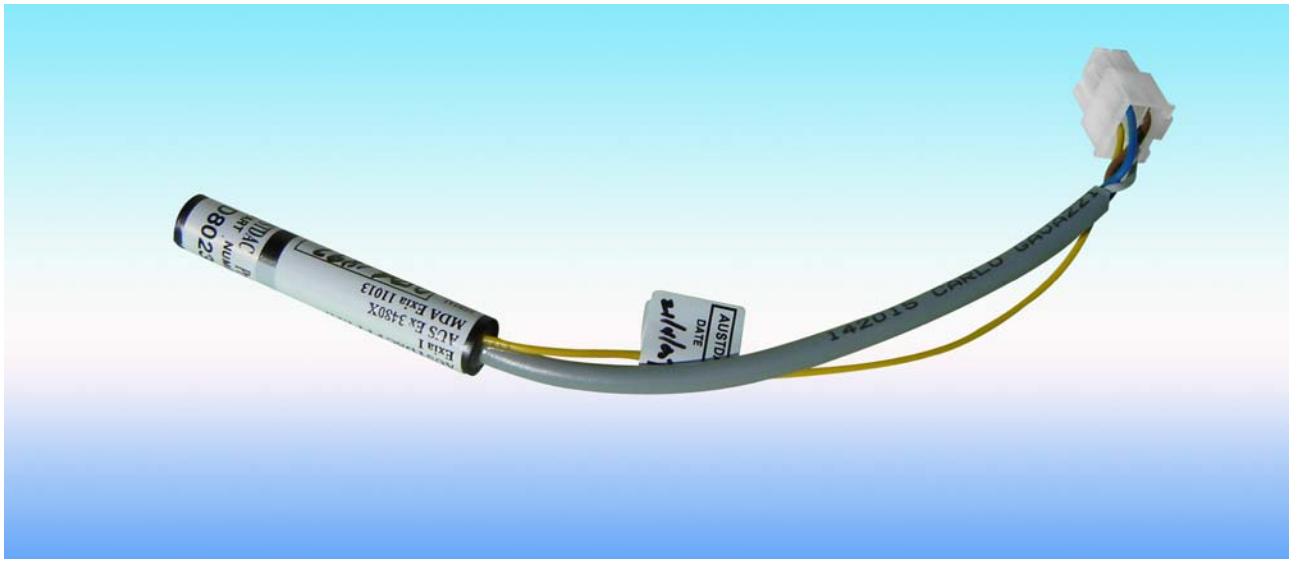


Figure 8. Zener Barrier type Z960 Wiring Details

13. DIGITAL TRANSMITTER TYPE 8023

The digital transmitter type 8023 is capable of transmitting one digital on off signal to the Dupline network. The 8023 occupies only one channel address on the Dupline network and its channel address is configured or programmed using a GAP1605 programmer. The 8023 is line powered so it does not require external power and is ideal for monitoring the state of voltage free contacts such as those incorporated in remote isolate switches, emergency stop switches and pull keys.
The 8023 is encapsulated within a small cylindrical housing with five flying leads for the Dupline network, programming and input signal connections. Photograph 6 shows the 8023 with its flying leads terminated in a six-pin Molex connector.



Photograph 6. 8023 digital transmitter and connector.

The 8023 may be wired directly into the installation or wired into the installation via the standard six-pin Molex connector to allow easy disconnection and removal for channel address programming and maintenance. The connection details of the 8023 digital transmitter are shown in table 16 below. The connector pin numbers are moulded into the rear face of the six-pin plug fitted to the digital transmitter.

DIGITAL TRANSMITTER TYPE 8023 CONNECTION DETAILS		
FUNCTION	WIRE COLOUR	CONNECTOR PIN NUMBER
PROGRAMMING VREG INPUT	WHITE	4
PROGRAMMING SCLK INPUT	BLACK	5
PROGRAMMING SDIDO OR DUPLINE SIGNAL	BROWN	6
CONTACT INPUT	YELLOW	2
DUPLINE COMMON OR PROGRAMMING GROUND	BLUE	3
NOT USED	-	1

Table 16. 8023 digital transmitter connection details.

The 8023 digital transmitter may be connected to the Dupline pair in two different ways; the first option has the transmitter powered all the time while the second option allows for the transmitter to be powered only when it is required to transmit the state of a closed voltage free field contact. This second option allows longer Dupline networks because non-transmitting transmitters are not consuming power. Figure 9 below shows the two connection options.

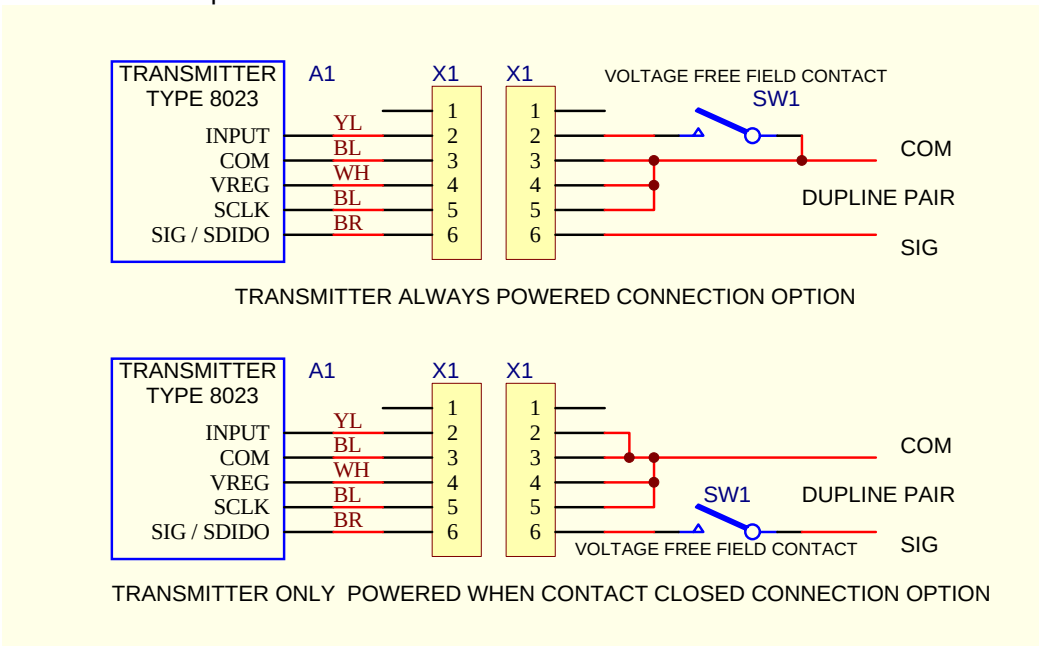


Figure 9. 8023 field termination details and options.

The 8023 digital transmitter must only be connected to voltage free contacts that are isolated and segregated from ground and other electrical circuits in accordance with table 17 below.

DIGITAL TRANSMITTER TYPE 8023 CONTACT INPUT SEGREGATION REQUIREMENTS			
ISOLATION TEST VOLTAGE	CLEARANCE	SEPARATION DISTANCE THROUGH SOLID INSULATION	CREEPAGE DISTANCE IN AIR
550V PEAK	7.0mm	1.2mm	15.0mm

Table 17. 8023 contact input segregation requirements.

The contacts used to switch the field contact input of the 8023 digital transmitter must be rated to handle the low voltages and extremely low currents involved; these typically are 5.0 volts and 5uA respectively. Failure to observe this requirement may lead to installations that are intermittent and unreliable, particularly if the voltage very contact is subject to vibration of the type present on conveyor structures.

The 8023 digital transmitter must only be configured or programmed with a type GAP1605 programmer when the 8023 is disconnected from the Dupline network and when the 8023 is not located within a hazardous area.

The 8023 digital transmitter may be supplied fitted within one of the following enclosures:

- Pullkey type ESS1 (SOLUS Pullkey)
- Enclosure type ESS2 (Austdac Pullkey)
- Enclosure type Lockout
- Belt wander switch type BWS1 or BWS2
- Belt tear switch type BTS1
- Belt blocked chute switch type BBCS1
- Belt man override switch type BMOS1

Up to 128 digital transmitters type 8023 may be connected to a Dupline network at any one time.

14. DIGITAL TRANSMITTER TYPE SILBUS8161

The single channel digital transmitter type SILBUS8161 is a low power and lower operating voltage alternative to the older 8023. All other operational aspects of the SILBUS8161 are identical to the 8023. The SILBUS8161 is housed in a slightly larger enclosure but maintains the same I/O connector and pin allocation as the 8023 making the SILBUS8161 and 8023 generally interchangeable.

The digital transmitter type SILBUS8161 is capable of transmitting one digital on off signal to the Dupline network. The SILBUS8161 occupies only one channel address on the Dupline network and its channel address is configured or programmed using a GAP1605 programmer. The SILBUS8161 is line powered so it does not require external power and is ideal for monitoring the state of voltage free contacts such as those incorporated in remote isolate switches, emergency stop switches and pull keys.

The SILBUS8161 is encapsulated within a small cylindrical housing with five flying leads for the Dupline network, programming and input signal connections. Photograph 7 shows the SILBUS8161 with its flying leads terminated in a six-pin Molex connector.

Photograph 7. SILBUS8161 digital transmitter and connector.

The SILBUS8161 may be wired directly into the installation or wired into the installation via the standard six-pin Molex connector to allow easy disconnection and removal for channel address programming and maintenance. The connection details of the SILBUS8161 digital transmitter are shown in table 18 below. The connector pin numbers are moulded into the rear face of the six-pin plug fitted to the digital transmitter.

DIGITAL TRANSMITTER TYPE SILBUS8161 CONNECTION DETAILS			
OPERATION FUNCTION	PROGRAM FUNCTION	WIRE COLOUR	CONNECTOR PIN NUMBER
DUPLINE COMMON	GND	GREY	3
NO CONNECTION	SCLK	YELLOW	5
DUPLINE SIGNAL	SDIDO	GREEN	6
CONTACT INPUT	NO CONNECTION	BROWN	2
NOT USED	NOT USED	-	4
NOT USED	NOT USED	-	1

Table 18. SILBUS8161 digital transmitter connection details.

The SILBUS8161 digital transmitter may be connected to the Dupline pair in two different ways; the first option has the transmitter powered all the time while the second option allows for the transmitter to be powered only when it is required to transmit the state of a closed voltage free field contact. This second option allows longer Dupline networks because non-transmitting transmitters are not consuming power. Figure 9 in the 8023 section of this manual shows the two connection options of the SILBUS8163.

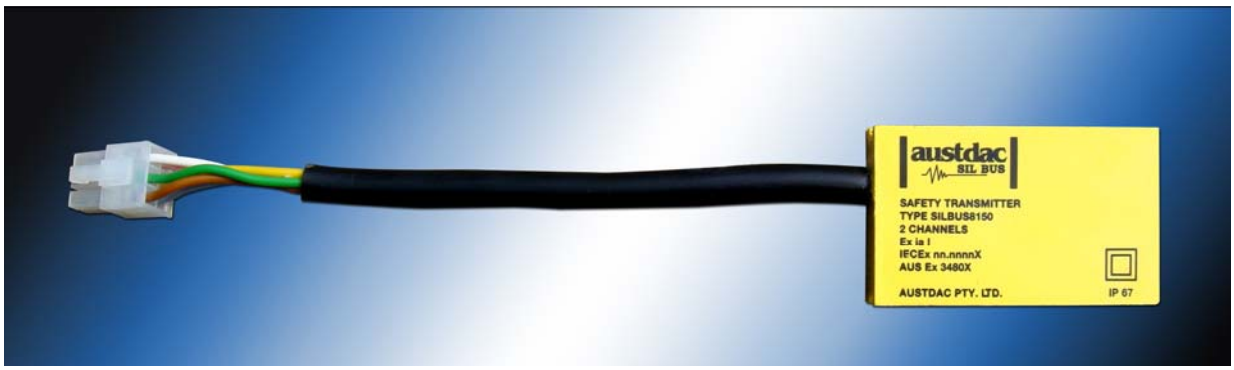
The SILBUS8161 digital transmitter must only be configured or programmed with a type GAP1605 programmer when the SILBUS8161 is disconnected from the Dupline network and when the SILBUS8161 is not located within a hazardous area.

Up to 128 digital transmitters type SILBUS8161 may be connected to a Dupline network at any one time.

15. SAFETY TRANSMITTER TYPE SILBUS8150

The safety transmitter type SILBUS8150 is a single channel digital transmitter that is capable of transmitting the status of a voltage free contact in such a way that the transmission can be awarded a safety integrity level (SIL) of 3. The SILBUS8150 is designed to be used in systems that require emergency stop, remote isolation or similar facilities within IEC/AS61508 and AS/IEC60621 compliant systems.

The safety transmitter can only be used in conjunction with the safety receiver type SILBUS8151 and together form a SIL3 capable secure transmission path over any Dupline fieldbus network. The transmission protocol between the safety transmitter(s) and the safety receiver(s) ensures the end to end integrity of the signal path. Up to 63 safety transmitters can be connected to a Dupline network. Each safety transmitter occupies two adjacent channels on the Dupline network. The safety transmitters can share the same network as other non safety related transmitters and receivers without a loss in the integrity of the safety transmission.



Photograph 8. Safety transmitter type SILBUS8150

The input to the safety transmitter type SILBUS8150 must be a voltage free contact that is completely isolated and segregated from ground or any other electrical circuits in accordance table 17. In order to achieve the full functionality of the safety transmitter it must be permanently connected to the Dupline network. This allows the receiver to obtain two lots of data; the status of the field contact and the integrity of the connection between the safety transmitter and safety receiver. The safety receiver combines this data to produce a functionally safe SIL 3 capable output signal.

SAFETY TRANSMITTER TYPE SILBUS8150 CONNECTION DETAILS		
MOLEX 6 PIN CONNECTOR	COLOUR	FUNCTION
PIN 6	BROWN	DUPLINE NETWORK SIGNAL
PIN 5	GREEN	CONFIGURATION RX
PIN 2	YELLOW	CONFIGURATION TX
PIN 3	GREY	DUPLINE NETWORK COMMON
PIN 1	PINK	CONTACT INPUT SOURCE
PIN 4	WHITE	CONTACT INPUT DRAIN

Table 19. Safety transmitter type SILBUS8150 connection details.

Basically the safety receiver output follows the input contact status provided that the transmission path integrity is not in question as a result of induced noise or an intermittent wiring fault. The safety receiver uses the transmission path integrity data to either allow the receiver output signal to follow the field contact status or fail over to a known safe position.

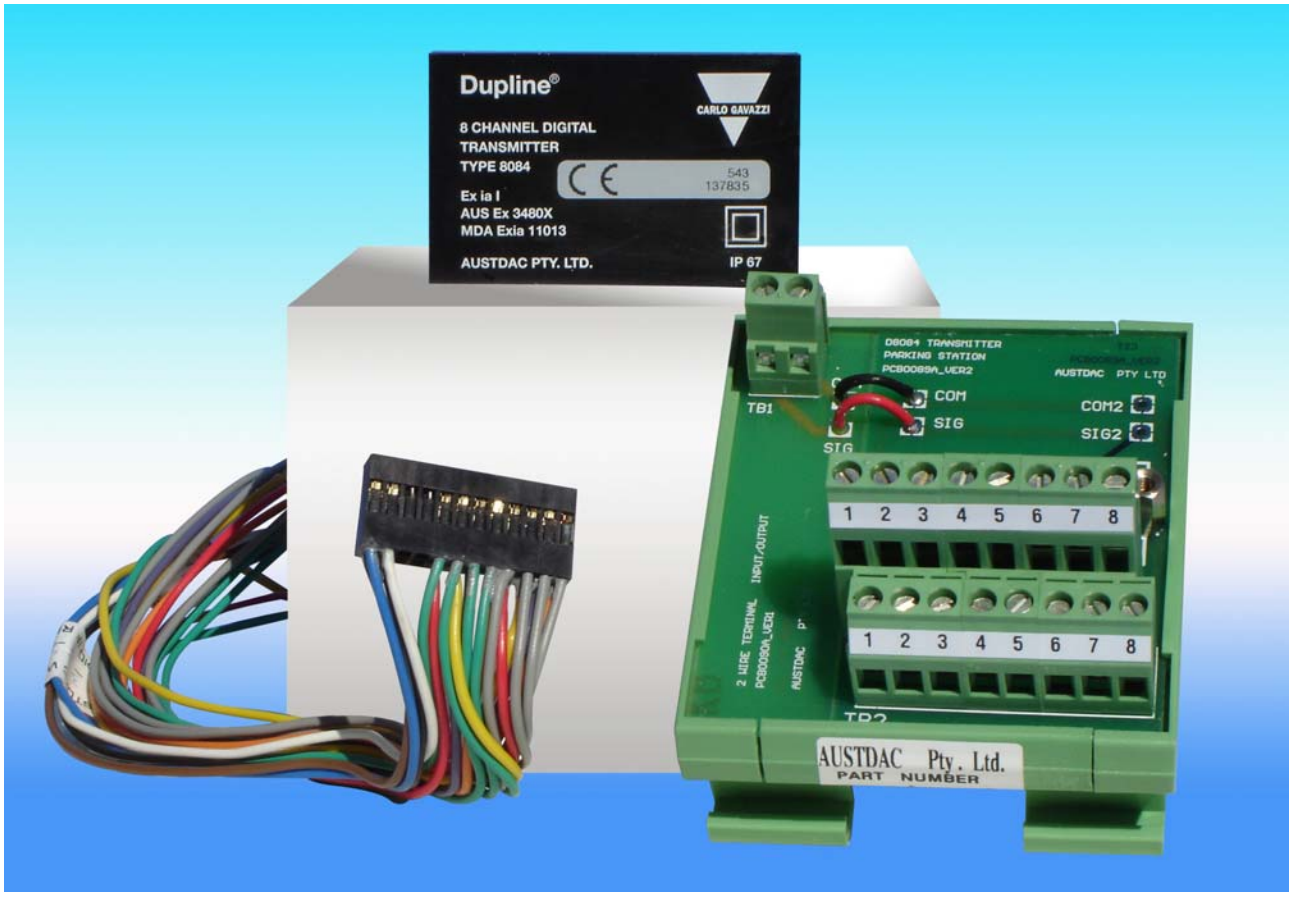
The functional safety description, failure rates and reliability parameters of the safety transmitter and receiver are given in a separate Austdac document titled “SILBUS safety transmitter type SILBUS8150 Safety Specification 120-052-11. The safety transmitter can only be programmed or configured outside the hazardous area using the safety programmer type SILBUS8152.

The safety transmitter can be wired directly into the Dupline network via the six pin Molex Minifit junior connector or connected via the safety transmitter type SILBUS8150 parking station. The use of parking stations designed for other transmitters may damage the safety transmitter.

16. DIGITAL TRANSMITTER TYPE 8084

The digital transmitter type 8084 is capable of transmitting the status of up to eight remote field contacts to the Dupline network. The 8084 requires one Dupline channel address per digital input used. The 8084 may be configured to only transmit those channels that are used and connected to voltage free field contacts, this eliminates the waste of Dupline channel address. The 8084 is configured and programmed using the GAP1605 programmer. The 8084 is line powered so it does not require external power and is ideal for monitoring the state of voltage free contacts such as those incorporated in remote isolate switches, emergency stop switches and pull keys.

The 8084 is encapsulated within a small rectangular enclosure with 20 pins for the Dupline network, programming and input signal connections. Photograph 5 shows the 8084 along with the two options of hardware used to allow the transmitter to be connected to the network and the voltage free field contacts.



Photograph 9. 8084 digital transmitter and termination options.

The 8084 digital transmitter must only be connected to voltage free contacts that are isolated and segregated from ground and other electrical circuits in accordance with table 20 below.

DIGITAL TRANSMITTER CONTACT INPUT SEGREGATION REQUIREMENTS			
ISOLATION TEST VOLTAGE	CLEARANCE	SEPARATION DISTANCE THROUGH SOLID INSULATION	CREEPAGE DISTANCE IN AIR
550V PEAK	7.0mm	1.2mm	15.0mm

Table 20. Digital Transmitter contact input segregation requirements.

The contacts used to switch the field contact input of the 8084 digital transmitter must be rated to handle the low voltages and extremely low currents involved, these typically are 5.0 volts and 5uA respectively. Failure to observe this requirement may lead to installations that are intermittent and unreliable, particularly if the voltage free contact is subject to vibration of the type present on conveyor structures.

The 8084 may be wired into the installation using the wiring harness or the transmitter parking station type D8084TPS08 to allow easy disconnection and removal for channel address programming and maintenance. The connection details of the 8084 transmitter and termination options are shown in table 21 below.

DIGITAL TRANSMITTER TYPE 8084 CONNECTION DETAILS				
8084 PIN	OPERATIONAL FUNCTION	PROGRAMMING FUNCTION	HARNESS WIRE COLOUR	PARKING STATION TERMINAL
1	DUP SIGNAL	SDIDO	BROWN	TB1-1
2	DUP COMMON	GROUND	BLUE	TB1-2
3	NO CONNECTION	SCLK	BLACK	-
4	NO CONNECTION	VREG	WHITE	-
5	-	-	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	SWITCH INPUT 8	NO CONNECTION	RED	TB2-9
10	SWITCH COMMON	NO CONNECTION	GREEN	TB2-8
11	SWITCH INPUT 7	NO CONNECTION	YELLOW	TB2-10
12	SWITCH COMMON	NO CONNECTION	GREEN	TB2-7
13	SWITCH INPUT 6	NO CONNECTION	VIOLET	TB2-11
14	SWITCH COMMON	NO CONNECTION	GREEN	TB2-6
15	SWITCH INPUT 5	NO CONNECTION	ORANGE	TB2-12
16	SWITCH COMMON	NO CONNECTION	GREEN	TB2-5
17	SWITCH INPUT 4	NO CONNECTION	RED	TB2-13
18	SWITCH COMMON	NO CONNECTION	GREY	TB2-4
19	SWITCH INPUT 3	NO CONNECTION	YELLOW	TB2-14
20	SWITCH COMMON	NO CONNECTION	GREY	TB2-3
21	SWITCH INPUT 2	NO CONNECTION	VIOLET	TB2-15
22	SWITCH COMMON	NO CONNECTION	GREY	TB2-2
23	SWITCH INPUT 1	NO CONNECTION	ORANGE	TB2-16
24	SWITCH COMMON	NO CONNECTION	GREY	TB2-1

Table 21. Digital transmitter type 8084 connection details

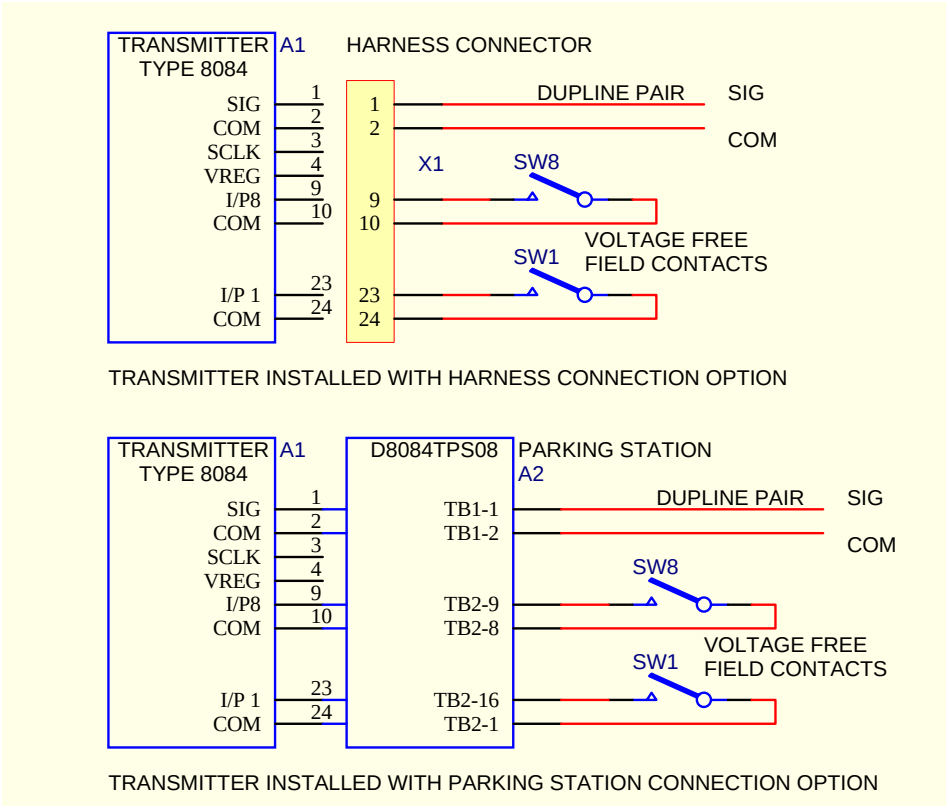


Figure 10. Transmitter type 8084 field termination details and options

17. DIGITAL TRANSMITTER TYPE SILBUS 8163

The eight channel digital transmitter type SILBUS8163 is a low power and lower operating voltage alternative to the older 8084 transmitter. All other operational aspects of the SILBUS8163 are identical to the 8084. The SILBUS8163 is housed in the same enclosure and maintains the same I/O connector and pin allocation as the earlier 8084 making the SILBUS8163 and 8084 generally interchangeable.

The digital transmitter type SILBUS8163 is capable of transmitting eight digital on off signals to the Dupline network. The SILBUS8163 occupies eight channel addresses on the Dupline network and its channel addresses are configured or programmed using a GAP1605 programmer. The SILBUS8163 is line powered so it does not require external power and is ideal for monitoring the state of voltage free contacts such as those incorporated in remote isolate switches, emergency stop switches and pull keys.

The SILBUS8163 is encapsulated within a small rectangular enclosure with 20 pins for the Dupline network, programming and input signal connections. The SILBUS8163 uses the same connection and wiring hardware as the earlier 8084, see the 8084 section in this manual for further details on these connection facilities.

Photograph 10. Digital transmitter type SILBUS8163

The contacts used to switch the field contact inputs of the SILBUS8163 digital transmitter must be rated to handle the low voltages and extremely low currents involved; these typically are 3.0 volts and 5uA respectively. Failure to observe this requirement may lead to installations that are intermittent and unreliable, particularly if the voltage free contact is subject to vibration of the type present on conveyor structures.

Refer to table 21 and figure 10 in the 8084 section of this manual for details on the connection and wiring of the eight channel digital transmitter type SILBUS8163.

18. ANALOGUE TRANSMITTER TYPE ATX4A

The analogue transmitter type ATX4A is housed with an IP40 DIN rail mounting plastic enclosure measuring 150mm x 75mm x 50mm and allows up to four analogue values to be transmitted to the Dupline network. The ATX4A transmits its values using the Analink protocol described in section 4 of this manual. The ATX4A will operate on 32, 64 or 128 channel Dupline networks. The ATX4A accepts 4-20mA or 0.4-2.0V signals as

inputs. The ATX4A is powered from a separate intrinsically safe power source of between 7 and 16 volts and draws less than 10mA.

Photograph 11. Analogue transmitter type ATX4A

CONFIGURATION

The four Dupline network channels used by the ATX4A are consecutive and are either the first four or last four of a Dupline address group i.e. A1 to A4 or J5 to J8. The Dupline address selection is carried out by setting two sixteen position rotary switches labelled “mode” and “channel”. These switches are located under the removable clear plastic front cover of the unit. Table 22 below shows the setting of the mode switch.

ATX4A MODE SWITCH SETTING DETAILS			
SWITCH POSITION	No. OF NETWORK CHANNELS	TX CHANNEL ADDRESSES	VALID DUPLINE ADDRESS GROUPS
0	TEST MODE	SEE 76-223-09	
1	32	CH1 ~ CH4 OF GROUP	A, B, C and D
2	64	CH1 ~ CH4 OF GROUP	A, B, C, D, E, F, G and H
3	128	CH1 ~ CH4 OF GROUP	A, B, C, D, E, F, G, H, I, J, K, L, M, N, O and P
4	32	CH5 ~ CH8 OF GROUP	A, B, C and D
5	64	CH5 ~ CH8 OF GROUP	A, B, C, D, E, F, G and H
6	128	CH5 ~ CH8 OF GROUP	A, B, C, D, E, F, G, H, I, J, K, L, M, N, O and P
7 through F	NOT VALID	NOT VALID	NOT VALID

Table 22. ATX4A Mode Switch Setting Details

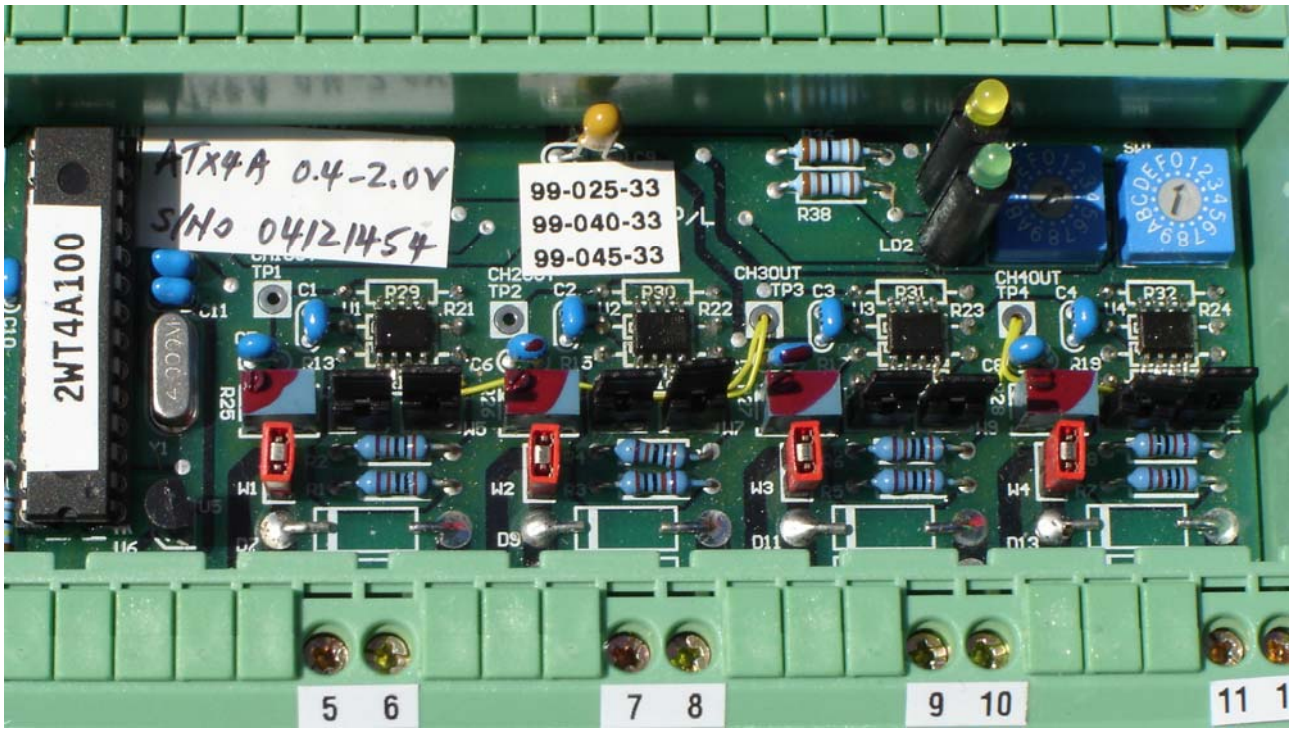
For example if the mode switch is in position 6 and the channel switch is in position A then the ATX4A will be configured to transmit the four analogue values on Dupline addresses K5, K6, K7 and K8.

Table 23 below shows the setting of the channel switch.

ATX4A CHANNEL SWITCH SETTING DETAILS		
SWITCH POSITION	DUPLINE NETWORK ADDRESS GROUP	VALID MODE SWITCH SETTINGS
0	A	1, 2, 3, 4, 5 and 6
1	B	1, 2, 3, 4, 5 and 6
2	C	1, 2, 3, 4, 5 and 6
3	D	1, 2, 3, 4, 5 and 6
4	E	2, 3, 5 and 6
5	F	2, 3, 5 and 6
6	G	2, 3, 5 and 6
7	H	2, 3, 5 and 6
8	I	3 and 6
9	J	3 and 6
A	K	3 and 6
B	L	3 and 6
C	M	3 and 6
D	N	3 and 6
E	O	3 and 6
F	P	3 and 6

Table 23. ATX4A Channel Switch Setting Details

The ATX4A may be configured to accept current or voltage type input signals. Each input can be independently configured to voltage or current by inserting or removing links on the printed circuit board of the ATX4A. Photograph 12 below shows the location of the current / voltage configuration links (red).



Photograph 12. Analogue Input Configuration Link Location

Table 24 below shows the analogue input configuration link setting details.

ATX4A ANALOGUE INPUT VOLTAGE – CURRENT CONFIGURATION DETAILS		
INPUT CHANNEL	LINK OUT - VOLTAGE	LINK IN - CURRENT
1	W1	W1
2	W2	W2
3	W3	W3
4	W4	W4

Table 24 ATX4A Analogue input configuration details

I/O CONNECTIONS

The analogue transmitter field terminal allocations are shown in table 25 below.

ATX4A ANALOGUE TRANSMITTER INPUT - OUTPUT TERMINAL ASSIGNMENTS			
PIN No.	TERMINAL BLOCK	FUNCTION	SIGNAL
1	TB1A	POWER SUPPLY	POWER +VE
2	TB1B		POWER –VE
3	TB2A	DUPLINE NETWORK	SIGNAL
4	TB2B		COMMON
5	TB3B	ANALOGUE I/P 1	HIGH +VE
6	TB3A		LOW –VE
7	TB4B	ANALOGUE I/P 2	HIGH +VE
8	TB4A		LOW –VE
9	TB5B	ANALOGUE I/P 3	HIGH +VE
10	TB5A		LOW –VE
11	TB6B	ANALOGUE I/P 4	HIGH +VE
12	TB6A		LOW –VE

Table 25. ATX4A Terminal Assignments

INDICATIONS

The four channel analogue transmitter has two LEDs to indicate the status of the unit. The “status” LED is yellow in colour while the “carrier” LED is green in colour. The carrier LED when illuminated indicates that the ATX4A has detected Dupline carrier (pulse train) on the Dupline network pair. The status LED indicates several states as shown in table 26 below.

ATX4A STATUS LED INDICATIONS		
STATE	INDICATION	MEANING
START UP	LED FLASHES AT 2 Hz 50% DUTY CYCLE FOR 3 SECONDS AFTER ATX4A IS POWERED UP	ATX4A IS POWERING UP
TEST MODE	LED FLASHES AT 0.5 Hz 50% DUTY CYCLE	ATX4A IS IN TEST MODE
OPERATIONAL	LED FLASHES AT 0.5 Hz 10% DUTY CYCLE	ATX4A IS OPERATING
FAULT	LED FLASHES AT 2 Hz 50% DUTY CYCLE	CONFIGURATION FAULT DETECTED MODE SWITCH SET TO 7 – F OR GROUP ADDRESS SET HIGHER THAN AVAILABLE CHANNELS SEE TABLE 18 AND 19 VALIDITY COLUMNS.

Table 26. ATX4A Status LED Indication Details

SPECIFICATIONS

Supply voltage ..... 7 – 16 VDC
Current consumption ..... 10mA max
Input signal type ..... 4-20mA or 0.4-2V
Input impedance ..... 100ohms for current inputs, 100K ohms for voltage inputs
Analogue input protection ..... 63mA fuse
Maximum input voltage 6.75V
Maximum input current 60mA
Resolution ..... 8 bit (62.5uA / bit)
Accuracy 1%
Response time ..... 18s for 64 channel system, 36s for 128 channel system
Dupline network current consumption ..... < 1mA
Operating temperature range ..... 0 – 40°C
Humidity (non-condensing) ..... 20 to 80%
Size ..... 150mm x 75mm x 50mm
Mounting ..... DIN rail TS35

19. ANALOGUE TRANSMITTER TYPE G3210 1161

The analogue transmitter type G3210 1161 is housed with an IP20 DIN rail mounting plastic enclosure measuring 35mm x 75mm x 70mm and allows one analogue value to be transmitted to the Dupline network. The G3210 1161 transmits this single value using the Analink protocol described in section 4 of this manual. The G3210 1161 will operate on 32, 64 or 128 channel Dupline networks. The G3210 1161 accepts a 4-20mA signal as its input. The G3210 1161derives its power from the Dupline network and is loop powered from the 4-20mA input. Galvanic isolation is provided between the Dupline network and he analogue input.

The G3210 1161 is configured using the GAP1605 field configuration tool. The G3210 1161 can be configured to transmit on any valid Dupline network address. See the section on the GAP1605 for configuration details.

Photograph 13. Analogue transmitter type G3210 1161

I/O CONNECTIONS

The analogue transmitter type G3210 1161 field terminal allocations are shown in table 27 below.

G3210 1161 ANALOGUE TRANSMITTER FIELD TERMINAL CONNECTION DETAILS		
PIN	FUNCTION	SIGNAL
1	DUPLINE NETWORK	DUPLINE SIGNAL
2		DUPLINE COMMON
21	ANALOGUE INPUT	HIGH +VE INPUT
22		LOW –VE INPUT

Table 27. G3210 1161 Connection Details.

SPECIFICATIONS

Signal input ..... 4 – 20mA
Analogue input voltage drop ..... 7V maximum
Resolution ..... 8 bit (62.5uA / bit)
Accuracy 1%
Response time ..... 18s for 64 channel system, 36s for 128 channel system
Channel programming GAP1605
Dupline network current consumption ..... < 600uA
Operating temperature range ..... 0 – 40°C
Humidity (non-condensing) ..... 20 to 80%
Maximum input current 60mA
Size ..... 35mm x 75mm x 70mm
Mounting ..... DIN rail TS35
Mass 100g

20. TEMPERATURE TRANSMITTER TYPE G3210 1112

The temperature transmitter type G3210 1112 is housed with an IP20 DIN rail mounting plastic enclosure measuring 35mm x 75mm x 70mm and allows one temperature value to be transmitted to the Dupline network. The G3210 1112 transmits this single temperature using the Analink protocol described in section 4 of this manual. The G3210 1112 will operate on 32, 64 or 128 channel Dupline networks. The G3210 1112 accepts an input from a 3-wire PT100 temperature sensor. The G3210 1112 derives its power from the Dupline network and consumes about 1.7mA from the network.

The G3210 1112 is configured using the GAP1605 field configuration tool. The G3210 1112 can be configured to transmit on any valid Dupline network address. See the section on the GAP1605 for configuration details.

Photograph 14. Temperature transmitter type G3210 1112

I/O CONNECTIONS

The temperature transmitter type G3210 1112 field terminal allocations are shown in table 28 below.

G3210 1112 TEMPERATURE TRANSMITTER FIELD TERMINAL CONNECTION DETAILS		
PIN	FUNCTION	SIGNAL
1	DUPLINE NETWORK	DUPLINE SIGNAL
2		DUPLINE COMMON
21	TEMPERATURE INPUT	DRIVE or SUPPLY
22		SENSE or INPUT
23		COMMON or GND

Table 28. G3210 1112 Connection Details.

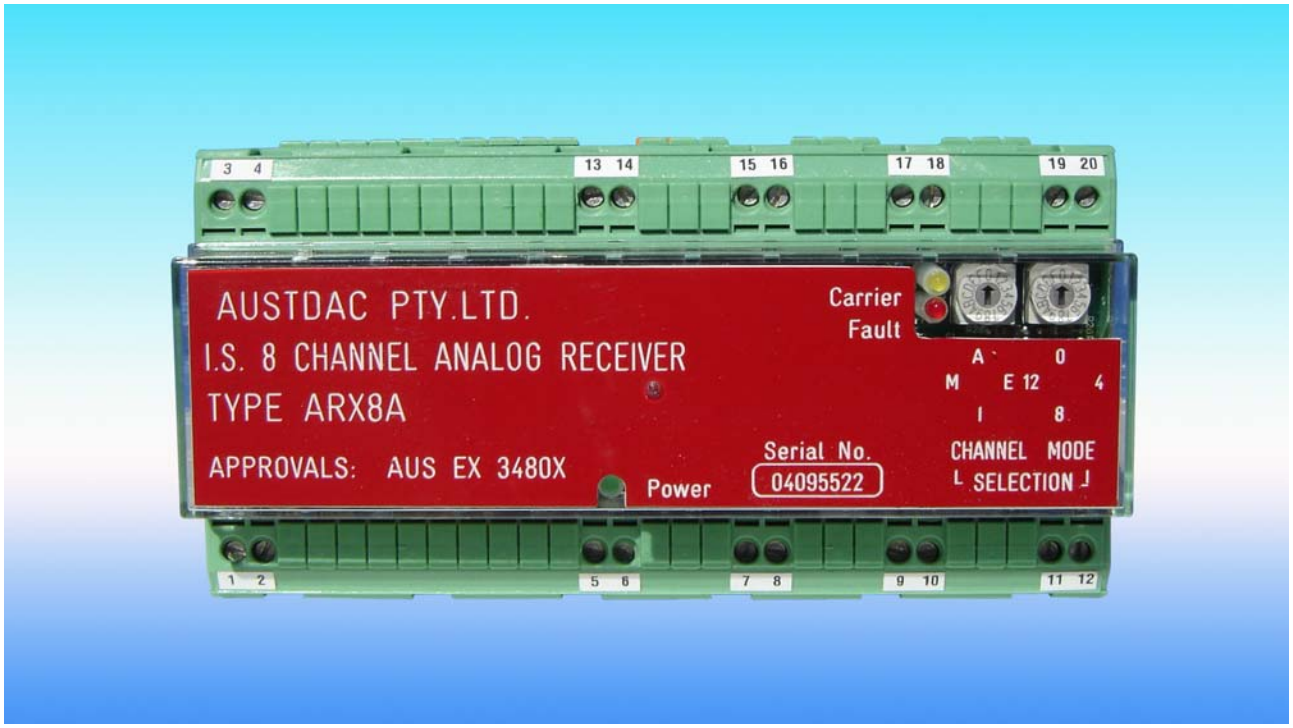
Pins 21 and 22 must be connected when two wire PT100 sensors are used. The two wire sensor is then connected between pin 22 and pin 23.

SPECIFICATIONS

Signal input ..... 4 – 20mA
Analogue input voltage drop ..... 7V maximum
Resolution ..... 8 bit (62.5uA / bit)
Accuracy 1%
Response time ..... 18s for 64 channel system, 36s for 128 channel system
Dupline network current consumption ..... < 1.7mA
Channel programming GAP1605
Operating temperature range ..... 0 – 40°C
Humidity (non-condensing) ..... 20 to 80%
Maximum input current 60mA
Size ..... 35mm x 75mm x 70mm
Mounting ..... DIN rail TS35
Mass 100g

21. ANALOGUE RECEIVER TYPE ARX8A

The analogue receiver type ARX8A is housed with an IP40 DIN rail mounting plastic enclosure measuring 150mm x 75mm x 50mm and allows up to eight analogue values to be received from the Dupline network. The ARX8A receives its values using the Analink protocol described in section 4 of this manual. The ARX8A will operate on 32, 64 or 128 channel Dupline networks. The ARX8A outputs analogue values in 4-20mA format. The ARX8A is powered from a separate intrinsically safe power source of between 7 and 16 volts and draws less than 10mA.



Photograph 15. Analogue Receiver type ARX8A

CONFIGURATION

The eight Dupline network channels used by the ARX8A are consecutive and occupy one complete Dupline address group i.e. A1 to A8 or J1 to J8. The Dupline address selection is carried out by setting two sixteen position rotary switches labelled “mode” and “channel”. These switches are located under the removable clear plastic front cover of the unit. Table 29 below shows the setting of the mode switch.

ARX8A MODE SWITCH SETTING DETAILS			
SWITCH POSITION	No. OF NETWORK CHANNELS	FUNCTION	VALID DUPLINE ADDRESS GROUPS
0	128	NORMAL OPERATION	A, B, C, D, E, F, G, H, I, J, K, L, M, N, O and P
1	-	TEST MODE ALL OUTPUTS = 0mA	-
2	-	TEST MODE ALL OUTPUTS = 4mA	-
3	-	TEST MODE ALL OUTPUTS = 12mA	-
4	-	TEST MODE ALL OUTPUTS = 20mA	-
5	-	TEST MODE ALL O/P’s RAMP 0mA – 20mA	-
6 - D	Not valid	INVALID	-
E	32	NORMAL OPERATION	A, B, C and D
F	64	NORMAL OPERATION	A, B, C, D, E, F, G and H

Table 29. ARX8A Mode Switch Setting Details

For example if the mode switch is in position E and the channel switch is in position 3 then the ARX8A will be configured to receive the eight analogue values on Dupline addresses D1 through D8.

Table 30 below shows the setting of the channel switch.

ARX8A CHANNEL SWITCH SETTING DETAILS		
SWITCH POSITION	DUPLINE NETWORK ADDRESS GROUP	VALID MODE SWITCH SETTINGS
0	A	0, E and F
1	B	0, E and F
2	C	0, E and F
3	D	0, E and F
4	E	0 and F
5	F	0 and F
6	G	0 and F
7	H	0 and F
8	I	0
9	J	0
A	K	0
B	L	0
C	M	0
D	N	0
E	O	0
F	P	0

Table 30. ARX8A Channel Switch Setting Details

I/O CONNECTIONS

The analogue receiver field terminal allocations are shown in table 31 below.

ARX8A ANALOGUE TRANSMITTER INPUT - OUTPUT TERMINAL ASSIGNMENTS			
PIN No.	TERMINAL BLOCK	FUNCTION	SIGNAL
1	TB1B	POWER SUPPLY	POWER +VE
2	TB1A		POWER –VE
3	TB2A	DUPLINE NETWORK	SIGNAL
4	TB2B		COMMON
5	TB3B	ANALOGUE O/P 1	HIGH +VE
6	TB3A		LOW –VE
7	TB4B	ANALOGUE O/P 2	HIGH +VE
8	TB4A		LOW –VE
9	TB5B	ANALOGUE O/P 3	HIGH +VE
10	TB5A		LOW –VE
11	TB6B	ANALOGUE O/P 4	HIGH +VE
12	TB6A		LOW –VE
13	TB7A	ANALOGUE O/P 5	HIGH +VE
14	TB7B		LOW –VE
15	TB8A	ANALOGUE O/P 6	HIGH +VE
16	TB8B		LOW –VE
17	TB9A	ANALOGUE O/P 7	HIGH +VE
18	TB9B		LOW –VE
19	TB10A	ANALOGUE O/P 8	HIGH +VE
20	TB10B		LOW –VE

Table 31. ARX8A Terminal Assignments

INDICATIONS

The eight channel analogue receiver has three LEDs to indicate the status of the unit. The “carrier” LED is yellow in colour, the “power” LED is green and the “fault” LED is red in colour. The carrier LED when illuminated indicates that the ARX8A has detected Dupline carrier (pulse train) on the Dupline network pair. The power LED when illuminated indicates that DC power is connected. The fault LED indicates several states as shown in table 32 below.

ARX8A FAULT LED INDICATIONS		
STATE	INDICATION	MEANING
START UP	LED FLASHES AT 2 Hz 50% DUTY CYCLE FOR 3 SECONDS AFTER ATX4A IS POWERED UP	ARX8A IS POWERING UP
FAULT	LED FLASHES AT 2 Hz 50% DUTY CYCLE	CONFIGURATION FAULT DETECTED MODE SWITCH SET TO 6 – D OR GROUP ADDRESS SET HIGHER THAN AVAILABLE CHANNELS SEE TABLE 18 AND 19 VALIDITY COLUMNS.

Table 32. ARX8A Status LED Indication Details

MAXIMUM LOAD RESISTANCE

The output of the ARX8A is a current source and is therefore susceptible to maximum load resistance and minimum loop supply voltage restrictions. The load resistance is made up of the output wiring resistance and the input resistance of the load device connected to the output of the ARX8A. For the 4-20mA current loop to function correctly the load resistance should not exceed the value determined by the formula below for the given loop voltage. The loop voltage for the ARX8A is the supply voltage at terminals 1 and 2.

$$Rmax = [(Vsupply – 1) / 0.02] –100$$

Where:

Rmax is the maximum load resistance in ohms

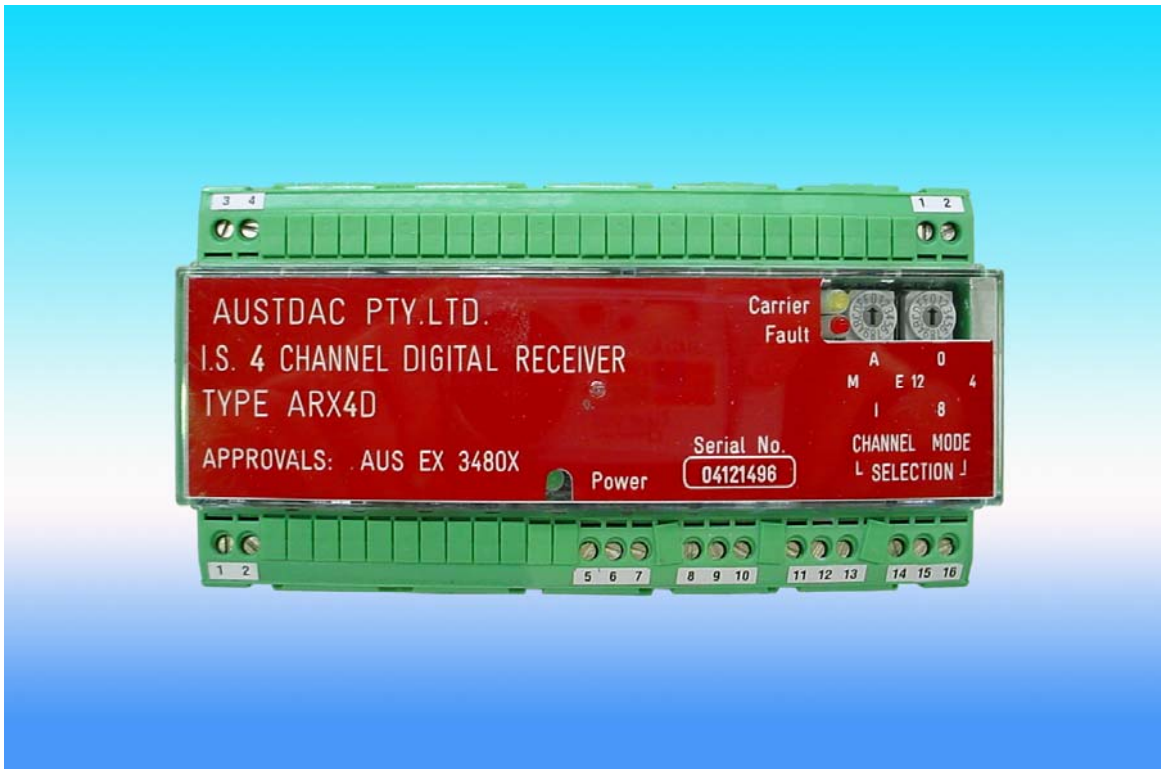
Vsupply is the ARX8A supply voltage at power supply terminals

SPECIFICATIONS

Supply voltage ..... 9 – 24 VDC
Current consumption ..... 10mA Plus current for each analogue output at 20mA max each
Output signal type 4-20mA
Resolution ..... 8 bit (62.5uA / bit)
Accuracy 1%
Response time ..... 18s for 64 channel system, 36s for 128 channel system
Dupline network current consumption ..... < 1mA
Channel programming GAP1605
Operating temperature range ..... 0 – 40°C
Humidity (non-condensing) ..... 20 to 80%
Analogue output protection ..... 63mA fuse
Maximum output current 63mA
Size ..... 150mm x 75mm x 50mm
Mounting ..... DIN rail TS35

22. DIGITAL RECEIVER TYPE ARX4D

The digital receiver type ARX4D is housed with an IP40 DIN rail mounting plastic enclosure measuring 150mm x 75mm x 50mm and allows up to four digital signals to be received from the Dupline network. The ARX4D will operate on 32, 64 or 128 channel Dupline networks. The ARX4D outputs digital signals as voltage free change over contacts. The ARX4D is powered from a separate intrinsically safe power source of between 7 and 16 volts and draws less than 10mA.



Photograph 16. Digital Receiver type ARX4D

CONFIGURATION

The four Dupline network channels used by the ARX4D are consecutive and occupy the lower or higher four channels of one complete Dupline address group i.e. A1 to A4 or J5 to J8. The Dupline address selection is carried out by setting two sixteen position rotary switches labelled “mode” and “channel”. These switches are located under the removable clear plastic front cover of the unit. Table 33 below shows the setting of the mode switch.

ARX4D MODE SWITCH SETTING DETAILS			
SWITCH POSITION	No. OF NETWORK CHANNELS	FUNCTION	VALID DUPLINE ADDRESS GROUPS
0	-	TEST MODE	-
1	AUTO	SELECTS LOWER 4 CHANNELS OF ADDRESS GROUP e.g. G1 – G4	A, B, C, D, E, F, G, H, I, J, K, L, M, N, O and P
2	AUTO	SELECTS UPPER 4 CHANNELS OF ADDRESS GROUP e.g. G5 – G8	A, B, C, D, E, F, G, H, I, J, K, L, M, N, O and P
3 - F	-	SPECIAL LOGIC FUNCTIONS – AND, OR, SPECIFIC CHANNEL(S). SEE 79-009-22 FOR DETAILS	VARIES – SEE 79-009-22 FOR DETAILS

Table 33. ARX4D Mode Switch Setting Details

For example if the mode switch is in position 1 and the channel switch is in position 9 then the ARX4D will be configured to receive the four digital signals on Dupline addresses J1 through J4.
Whenever positions 3 through F are selected the channel switch may be overridden and specific addresses and logic functions will be enabled. These addresses and logic functions are described in Austdac document 79-009-22.

Table 34 below shows the setting of the channel switch.

ARX4D CHANNEL SWITCH SETTING DETAILS		
SWITCH POSITION	DUPLINE NETWORK ADDRESS GROUP	VALID MODE SWITCH SETTINGS
0	A	1 through F
1	B	1 through F
2	C	1 through F
3	D	1 through F
4	E	1 through F
5	F	1 through F
6	G	1 through F
7	H	1 through F
8	I	1 through F
9	J	1 through F
A	K	1 through F
B	L	1 through F
C	M	1 through F
D	N	1 through F
E	O	1 through F
F	P	1 through F

Table 34. ARX4D Channel Switch Setting Details

I/O CONNECTIONS

The digital receiver field terminal allocations are shown in table 35 below.

ARX4D ANALOGUE TRANSMITTER INPUT - OUTPUT TERMINAL ASSIGNMENTS			
PIN No.	TERMINAL BLOCK	FUNCTION	SIGNAL
1	TB1B	POWER SUPPLY	POWER +VE
2	TB1A		POWER –VE
3	TB2A	DUPLINE NETWORK	SIGNAL
4	TB2B		COMMON
5	TB3C	DIGITAL O/P 1	NORMALLY CLOSED
6	TB3B		NORMALLY OPEN
7	TB3A		COMMON
8	TB4C	DIGITAL O/P 2	NORMALLY CLOSED
9	TB4B		NORMALLY OPEN
10	TB4A		COMMON
11	TB5C	DIGITAL O/P 3	NORMALLY CLOSED
12	TB5B		NORMALLY OPEN
13	TB5A		COMMON
14	TB6C	DIGITAL O/P 4	NORMALLY CLOSED
15	TB6B		NORMALLY OPEN
16	TB6A		COMMON

Table 35. ARX4D Terminal Assignments

INDICATIONS

The eight channel analogue receiver has three LEDs to indicate the status of the unit. The “carrier” LED is yellow in colour, the “power” LED is green and the “fault” LED is red in colour. The carrier LED when illuminated indicates that the ARX8A has detected Dupline carrier (pulse train) on the Dupline network pair. The power LED when illuminated indicates that DC power is connected. The fault LED indicates several states as shown in table 36 below.

ARX4D FAULT LED INDICATIONS		
STATE	INDICATION	MEANING
START UP	LED FLASHES AT 2 Hz 50% DUTY CYCLE FOR 3 SECONDS AFTER ATX4A IS POWERED UP	ARX4D IS POWERING UP
FAULT	LED FLASHES AT 2 Hz 50% DUTY CYCLE	CONFIGURATION FAULT DETECTED MODE SWITCH SET TO 6 – D OR GROUP ADDRESS SET HIGHER THAN AVAILABLE CHANNELS SEE TABLE 18 AND 19 VALIDITY COLUMNS.

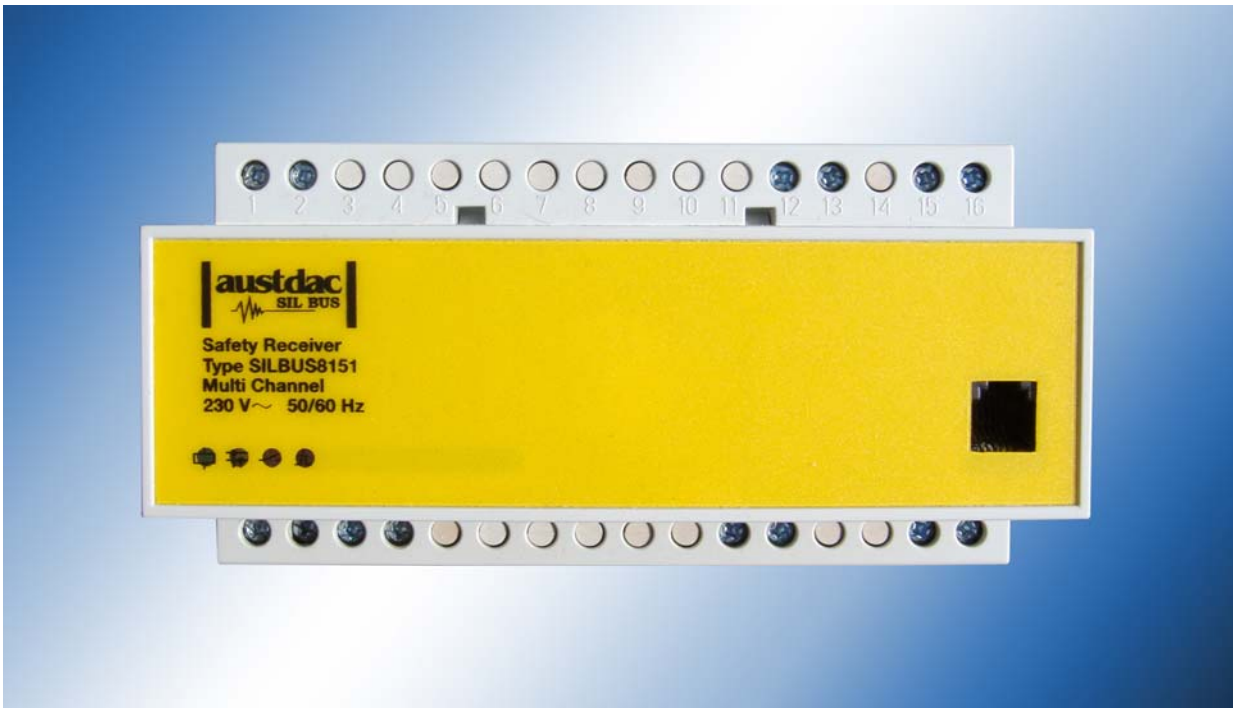
Table 36. ARX4D Status LED Indication Details

SPECIFICATIONS

Supply voltage ..... 9-12 VDC
Current consumption .....10mA, Plus current for each digital output at 21mA max each
Output signal type..... Voltage free change over contact
Maximum switching voltage.....30V
Maximum switching current ..... 1A at 30V non inductive
Dupline network current consumption .....< 1mA
Channel programming GAP1605
Operating temperature range ..... 0 – 40°C
Humidity (non-condensing)..... 20 to 80%
Size.....150mm x 75mm x 50mm
Mounting .....DIN rail TS35

23. SAFETY RECEIVER TYPE SILBUS8151

The safety receiver type SILBUS8151 is designed to be paired with from one to sixty three safety transmitters type SILBUS8150 to form a safety integrity level (SIL) 3 capable subsystem on the host Dupline network. The safety receiver is basically an AND receiver capable of accepting up to 63 safety inputs from up to 63 safety transmitters type SILBUS8150 located on the same Dupline network. The safety receiver is not certified explosion protected and therefore must not be installed within a hazardous area.



Photograph 17. Safety receiver type SILBUS8151

The safety receiver is housed within a DIN rail mounting enclosure measuring 143mm (L) x 75mm (W) x 70mm (H). The SILBUS8151 operates from 110 or 230 volts AC 50 or 60Hz. The safety receiver can only be configured or programmed using the safety programming unit type SILBUS8152 via the front panel mounted configuration port.

The functional safety description, failure rates and reliability parameters of the safety transmitter and receiver are given in a separate Austdac document titled “SILBUS safety transmitter type SILBUS8150 Safety Specification 120-052-11.

SAFETY RECEIVER TYPE SILBUS8151 CONNECTION DETAILS			
PIN	NAME	FUNCTION	COMMENT
1	SIG	DUPLINE SIGNAL	HOST DUPLINE FIELDBUS NETWORK
2	COM	DUPLINE COMMON	
12	RESTART		EXTERNAL VOLTAGE FREE CONTACT TO RE-CLOSE OUTPUT CONTACT AFTER SAFETY TRIP
13	RESTART		
15	STATUS O/P -	STATUS O/P NPN EMITTER	NPN TRANSISTOR OUTPUT CAPABLE OF SWITCHING 30V @ 50mA TO INDICATE STATUS OF SAFETY FUNCTION
16	STATUS O/P +	STATUS O/P NPN COLLECTOR	
21	PHASE	110V PRIMARY 1	21 LINKED WITH 23 = 110V PHASE 22 LINKED WITH 24 = 110V NEUTRAL OR 21 = 230V PHASE, 24 = 230V NEUTRAL WHEN 22 & 23 LINKED TOGETHER
22	NEUTRAL		
23	PHASE	110V PRIMARY 2	
24	NEUTRAL		
31	O/P CONTACT 1	O/P 1 COM	31 & 36 FAILSAFE SAFETY OUTPUT CONTACT 1 (3W OR 7VA MAX) 32 & 35 FAILSAFE SAFETY OUTPUT CONTACT 2 (3W OR 7VA MAX)
32	O/P CONTACT 2	O/P 2 COM	
35	O/P CONTACT 2	O/P 2 N/O	
36	O/P CONTACT 1	O/P 1 N/O	

Table 37. Safety receiver type SILBUS8151 connection details

24. TERMINATION UNIT TYPE DT01

The termination unit type DT01 is housed with an IP20 DIN rail mounting plastic enclosure measuring 18mm x 75mm x 70mm and is used to terminate the Dupline network pair, whenever reflections occur.

When a generator connected to a non-terminated cable emits a square wave signal, the cable end will always cause reflections. Depending on frequency and distance the signal can be distorted to a degree where the information becomes unreliable. However, these reflections can easily be removed by connecting the correct termination at the cable end. In the case of Dupline the critical distance between the generator and the far cable end is 2000m and above. Consequently if a DT01 termination unit is connected at the cable end when the distance to the channel generator exceeds 1200m, reflections will be avoided.

In case of branches on the cable, it is only necessary to connect a second DT01 if the distance to the nearest DT01 exceeds 1200m. In all other cases a second DT01 should not be connected as it increases line capacitance and thereby reduces transmission distance.

Photograph 18. Termination unit type DT01

I/O CONNECTIONS

The termination unit type DT01 field terminal allocations are shown in table 38 below.

DT01 TERMINATION UNIT FIELD TERMINAL CONNECTION DETAILS		
PIN	FUNCTION	SIGNAL
1	DUPLINE NETWORK	DUPLINE SIGNAL
2		DUPLINE COMMON

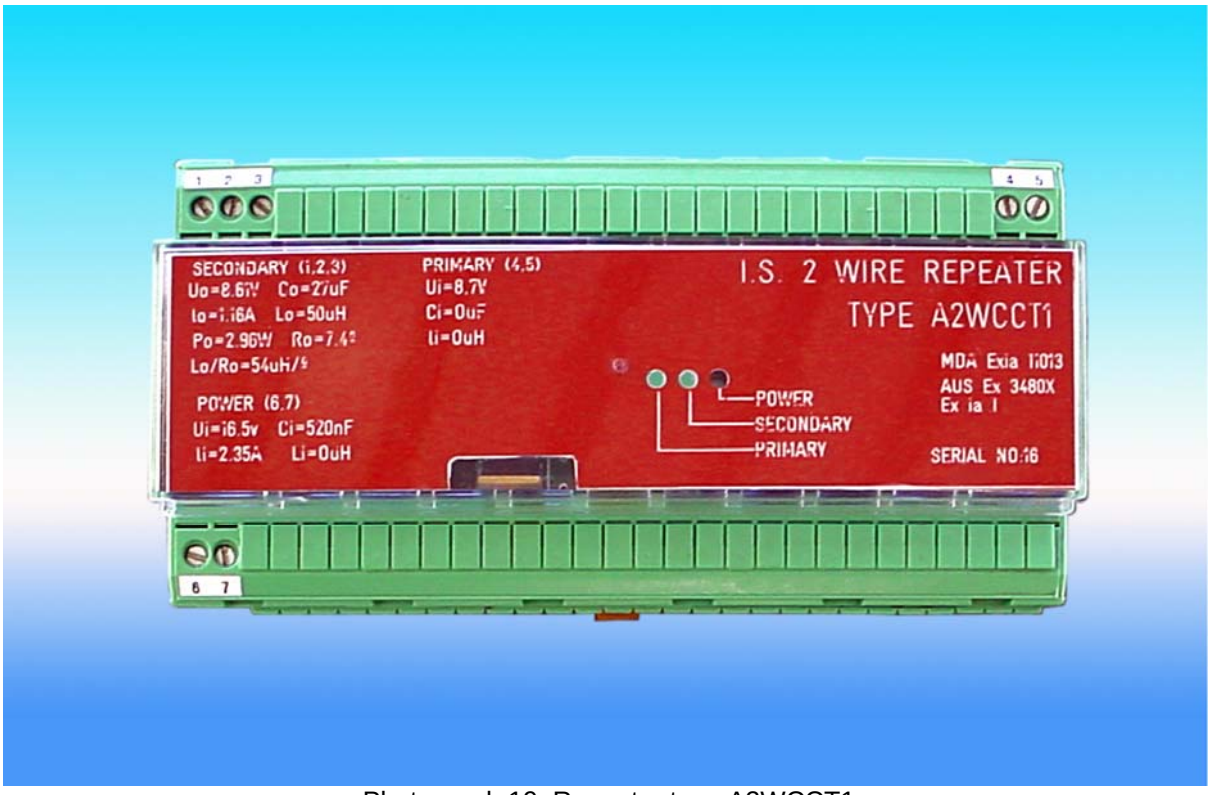
Table 38. DT01 Connection Details.

SPECIFICATIONS

Dupline network current consumption 220uA
Operating temperature range ..... 0 – 40°C
Humidity (non-condensing) ..... 20 to 80%
Maximum input current 60mA
Size ..... 18mm x 75mm x 70mm
Mounting ..... DIN rail TS35
Mass 45g

25. REPEATER TYPE A2WCCT1

The repeater type A2WCCT1 is housed with an IP40 DIN rail mounting plastic enclosure measuring 150mm x 75mm x 50mm. The Dupline repeater type A2WCCT1 is used to increase the distance of a Dupline network. Furthermore, it can be used as a power booster in sections of network that contain large number of load modules. The repeater introduces a delay of one Dupline scan when transferring pulses from the secondary Dupline to the primary Dupline, while pulses from primary Dupline to secondary Dupline are transferred with a maximum delay of 1mS. The A2WCCT1 is powered from a separate intrinsically safe power source of between 7 and 16 volts and draws less than 10mA.



Photograph 19. Repeater type A2WCCT1

I/O CONNECTIONS

The repeater field terminal allocations are shown in table 39 below.

A2WCCT1 REPEATER TERMINAL ASSIGNMENTS			
PIN No.	TERMINAL BLOCK	FUNCTION	SIGNAL
1	TB1B	SECONDARY DUPLINE OUT	SIGNAL
2	TB1A		COMMON
3	TB2A		NOISE REDUCTION CONNECT TO PIN 1 TO ENABLE
4	TB2B	PRIMARY DUPLINE IN	SIGNAL
5	TB3C		COMMON
6	TB3B	POWER SUPPLY	POWER +VE
7	TB3A		POWER -VE

Table 39. A2WCCT1 Terminal Assignments

INDICATIONS

The A2WCCT1 repeater has three green LEDs to indicate the status of the unit. The power LED when illuminated indicates that the repeater is powered from the external DC power source. The primary LED indicates that the repeater has detected Dupline carrier (pulse train) on the primary Dupline network pair. The secondary LED when illuminated indicates that the secondary Dupline network carrier is healthy i.e. is not overloaded or shorted.

SPECIFICATIONS

Supply voltage ..... 12-16 VDC
Current consumption ..... 120mA max
Primary Dupline network current consumption..... 600uA max
Operating temperature range ..... 0 – 40°C
Humidity (non-condensing)..... 20 to 80%
Size.....150mm x 75mm x 65mm
Mounting .....DIN rail TS35

26. TEST UNIT TYPE GTU8

The Dupline test unit type GTU8 is used to connect to the Dupline network and determine the state of or control the state of any valid channel address. The GTU8 is used in commissioning, trouble-shooting and maintenance to test the functionality of the system and its various connected modules.

Photograph 20. Test Unit Type GTU8

The GTU8 is a small hand held unit measuring 145mm x 90mm x 28mm and weighing 250 grams. It has a detachable cable that is used to connect the test unit to the Dupline network. It derives its power from the network.

When the GTU8 is taken into a hazardous area it must be carried and used within its leather case at all times, failure to do so will violate the conditions of certification. The leather case is provided with a clear window to allow operation when the case is fitted.

Care should be taken in using the test unit on systems that are used as safety systems. The activation of a channel by the test unit may complete the logic requirements for heavy plant to start. Always physically isolate power or control to heavy plant when fault finding on a Dupline network. Always test the system prior to returning heavy plant to system control.
TEST UNIT OPERATING INSTRUCTIONS

The GTU8 can be used anywhere along two wires to monitor and control the status of Dupline® channels. This unit is highly recommended for start-up and maintenance work on Dupline® systems.

The GTU8 can operate in 4 different modes:

- Digital 1 group
- Digital 2 groups
- Edit Tx-latch
- Analogue BCD

The start-up mode is “digital 1 group”.

To change mode:
Press << Mode >>
Shift between mode options by pressing either <<↑ >> or << ↓ >>.
Select mode by pressing << Enter >>.

Digital 1 group
Once connected to the Dupline®, the display shows the status of channel group A. Active channels are indicated by their numbers. Pressing <<1>>, <<2>>…<<8>> will activate the corresponding Dupline channel in the selected channel group.
Pressing << ↑ >> or << ↓ >> changes the channel group shown in the display.

Digital 2 groups
When the mode “digital 2 groups” is selected, the user may select an additional channel group for permanent monitoring on the bottom line of the display. The channel status of the two selected groups can now be monitored, but changing the channel status through the keys <<1>> … <<8>> only affects the channels displayed in the upper row of the display. Even so, pressing the <<↑ >> or << ↓ >> key only changes the channel group in the upper row of the display.

Edit Tx-latch
In this mode it is possible to “latch” the activation of one or more channels. This means that the GTU8 will continue transmitting on the channel(s) even though the corresponding transmission button is released.

To cancel the transmission on a channel, press the corresponding transmission button again.

The latched transmission will continue even if the channel group or mode is changed. In order to change the status of a latched transmission, it is necessary to re-enter the “Edit Tx-latch” mode.

All the latched channels are reset to normal Dupline® operation whenever the GTU8 becomes disconnected from the Dupline®.

Warning: Do no plug or unplug the Jack connector when the GTU8 is connected to Dupline®. This will cause a short-circuit of the Dupline network pair.

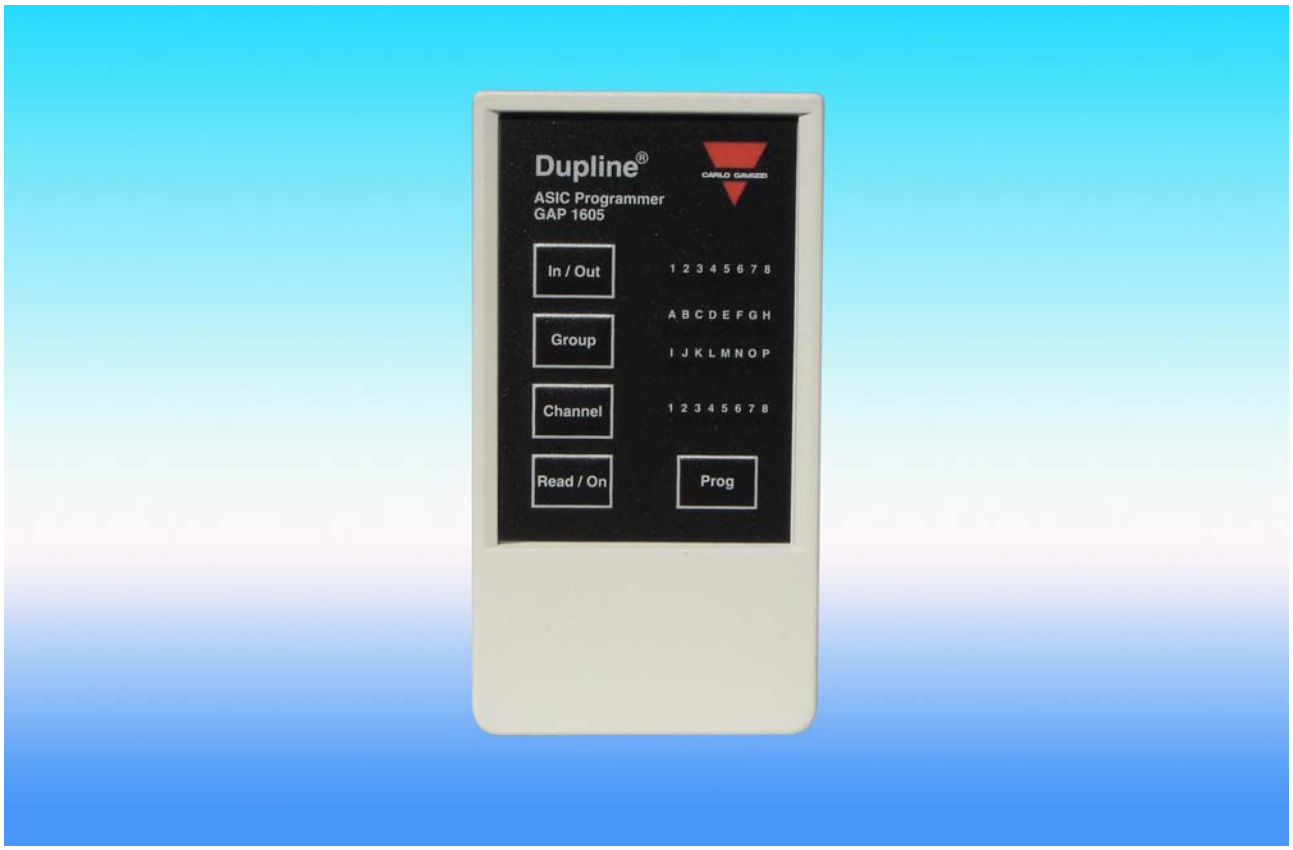
Note: If the Dupline® carrier is missing, the display will not turn on.

SPECIFICATIONS

Power supply	Derived from Dupline network
Dupline network current consumption	4mA max
Operating temperature range	0 – 40°C
Humidity (non-condensing)	20 to 80%
Size	145mm x 90mm x 28mm
Mass	250g

27. PROGRAMMER TYPE GAP1605

The Dupline programmer type GAP1605 is used to programme Dupline modules with their network address. The GAP1605 is used during commissioning, trouble-shooting and maintenance to ensure that replacement or additional modules are assigned the correct network address.



Photograph 21. Programmer Type GAP1605

The GAP1605 is a small hand held unit measuring 120mm x 65mm x 23mm and weighing 225 grams. It has a detachable cable that is used to connect the programmer to the programming port of the module to be programmed.

When the GAP1605 is taken into a hazardous area it must be carried and used within its leather case at all times, failure to do so will violate the conditions of certification. The leather case is provided with a clear window to allow operation when the case is fitted.

Never remove or replace the battery of the programmer while the programmer is located within a hazardous area, failure to do so will violate the conditions of certification.

Never programme a module that is connected to an active Dupline network, failure to do so will violate the conditions of certification.

Care should be taken in using the programmer on systems that are used as safety systems. The incorrect assignment of a channel address may complete the system logic requirements for heavy plant to start. Always physically isolate power or control to heavy plant when programming module addresses. Always test the system prior to returning heavy plant to system control.

PROGRAMMING UNIT OPERATING INSTRUCTIONS

The GAP 1605 is a portable programming unit used for reading or programming channel code(s) in the ASIC-based series of Dupline® products.

Once the battery is installed, the GAP 1605 is ready for use. Connect the cable between the programming unit and a Dupline® module type G.

Five keys provide the means of operating the GAP 1605: two keys are used for reading and programming, two keys for changing Groups and Channels and one key for selecting the desired Input/Output.

The current coding is displayed by 4 x 8 LEDs. The top row of LEDs displays the selected input or output. The two middle rows display the current channel group, while the bottom row displays the current channel code.

<< In/Out >> - Key
This key is used to scroll through the I/O's of a module. If a new module is connected or if consecutive channel codes are allocated to the I/O's, pressing the **<< In/Out >>** key has no effect since all Dupline® modules are pre-programmed to their physical number of inputs/outputs. This key is also used to switch between consecutive and individual coding of the I/O's. To change the mode, keep **<< In/Out >>** pressed for more than two seconds.

<< Group >> - Key
Used to select the Group address within the range A to P. The Group LED will shift one position right for each key activation.

<< Channel >> - Key
Used to select the channel(s) within the group. The Channel LED will shift right one, two, or four positions, depending on the number of inputs/outputs. If consecutive channels are selected then pressing the **<< Channel >>** key will have no effect.

<< Read/On >> - Key
Used to turn on the GAP 1605 and to read the channel codes of the connected module. When the reading is completed, the display will show the channel code of the module: either 1, 2, 4, or 8 inputs/outputs.

2, 4, or 8 In/Out LED's being ON indicates that consecutive channel codes are allocated to the I/O's, e.g. input 1 coded to P1, input 2 to P2 … input 8 to P8.

If only one In/Out LED is ON, then the I/O's are coded individually, e.g. input 1 to C5, input 2 to D4 etc. The code for each I/O is indicated by a group LED and a channel LED.

If the GAP 1605 is not connected to a Dupline® system, it will turn off within two seconds.

<< Prog >> - Key
When the displayed I/O-coding corresponds to the desired channel configuration, the codes will be downloaded to the Dupline® module when pressing the **<< Prog >>** key.

After programming is executed, verification takes place. If this verification fails, all activated LEDs in the display will flash two times, and the programming unit will switch off.

If such behaviour occurs repeatedly on the same module, the module may be faulty. If several modules fail to download, the GAP 1605 may be faulty.

Individual In/Out Channel Programming
The GAP 1605 features an additional mode of single-channel editing. Pressing **<< In/Out >>** for more than two seconds will change the operating mode to single point programming. The **<< In/Out >>** key is now used to select one of the eight possible inputs/outputs, thus making individual channel coding possible. The In/Out LEDs assign the display channel code to the corresponding physical input/output of the module.
In single mode the **<< Channel >>** key also has the ability to disable an In/Out position. **<< Channel >>** must simply be pressed past channel 8, whereby both the Channel LED and the Group LED will turn off. To re-enable, just press **<< Channel >>** again.

It is possible to change all eight Inputs/Outputs, even though some Dupline modules are built for only 1, 2, or 4 Inputs/Outputs.

To exit single channel programming, just keep the **<< In/Out >>** key pressed for two seconds.

Output Status Setting
On receivers, it is possible to configure the status of the outputs during Dupline® failure. Normally, any output of a receiver will go off during Dupline failure. In some cases, the inverted function is desirable (e.g. light applications – turn on light if the Dupline® is down).

To change output status, the GAP 1605 must be put into configuration mode. This is done as follows:
Remove any connected Dupline® system.
Keep both **<< In/Out >>** and **<< Group >>** pressed, while pressing **<< Read/On >>**.

The first In/Out LED now turns on. Connect the Dupline® system, and press **<< Read/On >>**. If output status is set, then channel LED 1 will illuminate. Pressing **<< Channel >>** will toggle the output status On/Off.
Press **<< Prog >>** to store.
If **<< Read/On >>** is pressed when no Dupline® system is connected, the LEDs will flash to indicate a false condition. Only a successful reading will reset this condition.

Other Features
To code a Dupline® module off-line, neither Dupline nor power to supply the module is required. Simply connect the module to the programmer and start coding.

If Online coding (module connected to an operating Dupline® system) is performed, the module automatically disconnects itself from the Dupline® and returns to normal operation after the programmer cable is disconnected.

The GAP 1605 automatically turns off when no key has been pressed within the last 30 seconds.

If the connection cable is removed from the Dupline® module, the GAP 1605 will switch off within two seconds.

Low Battery Indication
When battery is low, the In/Out row of LEDs will roll centre-wards in an eye catching manner.

Warning
When using the GAP 1605 you must connect the cable to the GAP 1605 before connecting the cable to any Dupline® module that is to be coded. Even so, the cable must first be removed from the Dupline® module before disconnecting it from the GAP 1605.
Without observing these precautions you may destroy the ASIC inside the Dupline® module through static discharges.

Caution
To ensure long battery life, always remember to remove the cable from the Dupline® modules. The Dupline® modules will be kept in an inactive state as long as the GAP 1605 is connected.

SPECIFICATIONS

Power supply	Derived from Dupline network
Dupline network current consumption	4mA max
Operating temperature range	0 – 40°C
Humidity (non-condensing)	20 to 80%
Size	145mm x 90mm x 28mm
Mass	250g

28. SAFETY CONFIGURATION UNIT TYPE SILBUS 8152

The safety configuration unit type SILBUS8152 is used to configure both the safety transmitter type SILBUS8150 and safety receiver type SILBUS8151. All configuration and programming must be done outside the hazardous area. The configuration is a battery powered unit measuring 90mm (W) x 145mm (L) x 30mm (H).

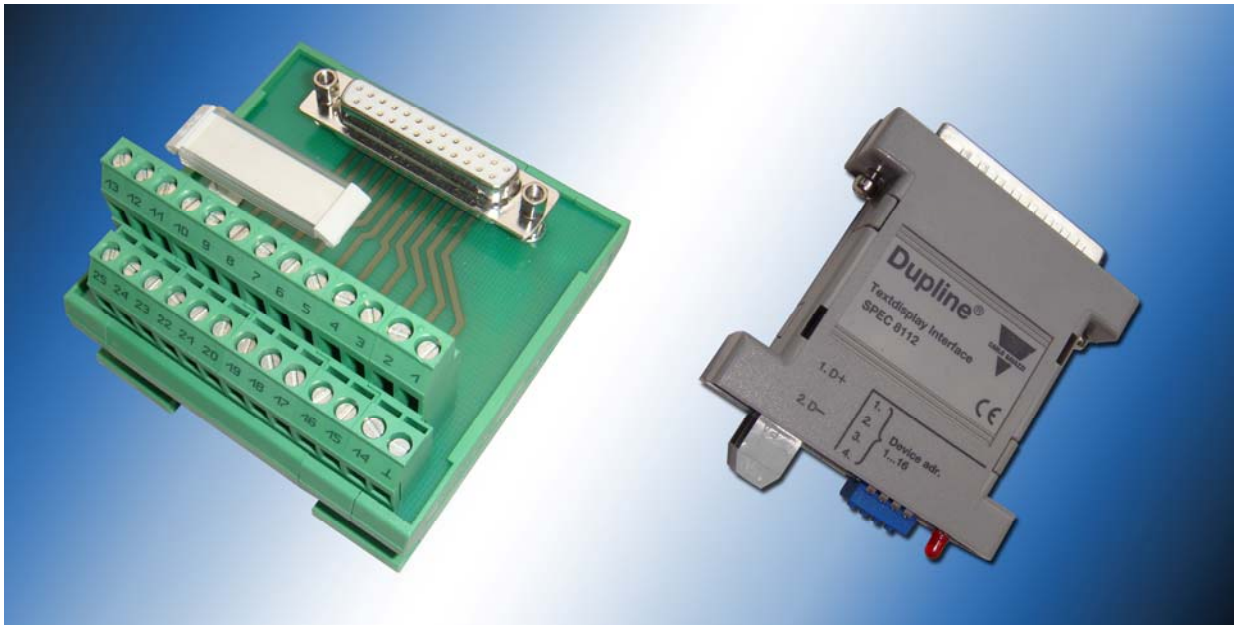
Photograph 22. Safety configuration unit type SILBUS8152

Refer to the configuration unit individual operators manual for instructions on use and configuring the SILBUS8150 or the SILBUS8151. The safety configuration unit should not be used to program other non safety devices as the configuration unit may be damaged.

29. MODBUS INTERFACE TYPE GTI50 SPEC 8112 AND GSTI50

The MODBUS interface types GTI50, GSTI50 or SPEC8112 are a small module physically based on a 25 way D type connector back-shell that acts as a MODBUS slave and interfaces to the host Dupline network. This allows a MODBUS master to poll for the status and value of the 128 channels on the host Dupline network. These interfaces also allow for the controlling of the channels of the host Dupline network.

The interfaces are typically mounted on a DIN rail carrier when installed in a conveyor control panel as shown in photograph 23 below. These interfaces are not certified as explosion protected equipment and therefore should not be used in a hazardous area.



Photograph 23. MODBUS Interface type GTI50, GSTI50 and SPEC 8112 shown with DIN rail mounting option

MODBUS INTERFACE TYPE GTI50, SPEC 8112 AND GSTI50 CONNECTION DETAILS		
D TYPE	TERMINAL	FUNCTION
-	1	HOST DUPLINE NETWORK SIGNAL
-	2	HOST DUPLINE NETWORK COMMON
7	-	POWER SUPPLY COMMON / GROUND
10	-	RS485 TX/RX- BALANCED COMMS
16	-	POWER SUPPLY INPUT +5V @ 45mA
22	-	RS485 TX/RX+ BALANCED COMMS

Table 40. MODBUS interface type GTI50, SPEC 8112 and GSTI50 connection details

MODBUS INTERFACE TYPE GTI50, SPEC 8112 AND GSTI50 SWITCH SETTING DETAILS		
SWITCH	GTI50 AND GSTI50 FUNCTION	SPEC 8112 FUNCTION
1	ADDRESS OFF = 01, ON = 02	MODBUS ADDRESS 1
2	BAUDRATE OFF = 9600, ON = 19K2	MODBUS ADDRESS 2
3	OFF = DISABLE DUPLINE OUTPUT ON = ENABLE DUPLINE OUTPUT	MODBUS ADDRESS 4
4	NOT USED	MODBUS ADDRESS 8

Table 41. MODBUS interface type GTI50, SPEC 8112 and GSTI50 switch setting details

The SPEC 8112 has fixed communications parameters; Baudrate of 9600, Parity of none, Databits of 8 and Stopbits of 1. The GTI50 and GSTI50 have the same communications parameters except that the baudrate can be altered by switch 2. These interfaces generally comply with the MODBUS RTU protocol with the exception of the parity bit set to none. **The MODBUS RTU protocol requires an even parity bit.**

The GTI50 and SPEC 8112 interfaces can provide a digital and analogue (analink) channel MODBUS interface. The GSTI50 is the only interface in this family other than the GSW1 channel generator that can provide a safety channel MODBUS interface. Refer to individual MODBUS register allocation documents for exact details on the data interface capabilities of these interface units.

All interfaces have a red LED to indicate MODBUS communications status and host Dupline network status. This LED flashes every ¼ second to indicate a host Dupline network fault and flashes extremely fast to indicate a response to a successful MODBUS request for information.

30. TAIL END UNIT TYPE TEU2

The tail end unit type TEU2 is primarily a member of the Austdac PSACS1 system and is certified as part of the PSACS1 and Dupline 128 systems, it is included here for completeness only. Please refer to the PSACS1 user's manual 20-079-12 for more detail.

31. BELT WANDER SWITCH TYPE BWS1

The belt wander switch type BWS1 is typically located in such a way that the belt edge just runs past the roller detection arm of the wander switch. If the belt should wander or move laterally the edge of the conveyor belt material will begin to touch the roller arm causing it to deflect and activate the internal switch of the BWS1. The roller action of the detection arm stops the belt material from abrading the detection arm. The BWS1 may contain any of the Dupline single channel digital transmitters or alternatively be wired to the input of a digital transmitter in a nearby enclosure.

Photograph 24. Belt wander switch type BWS1

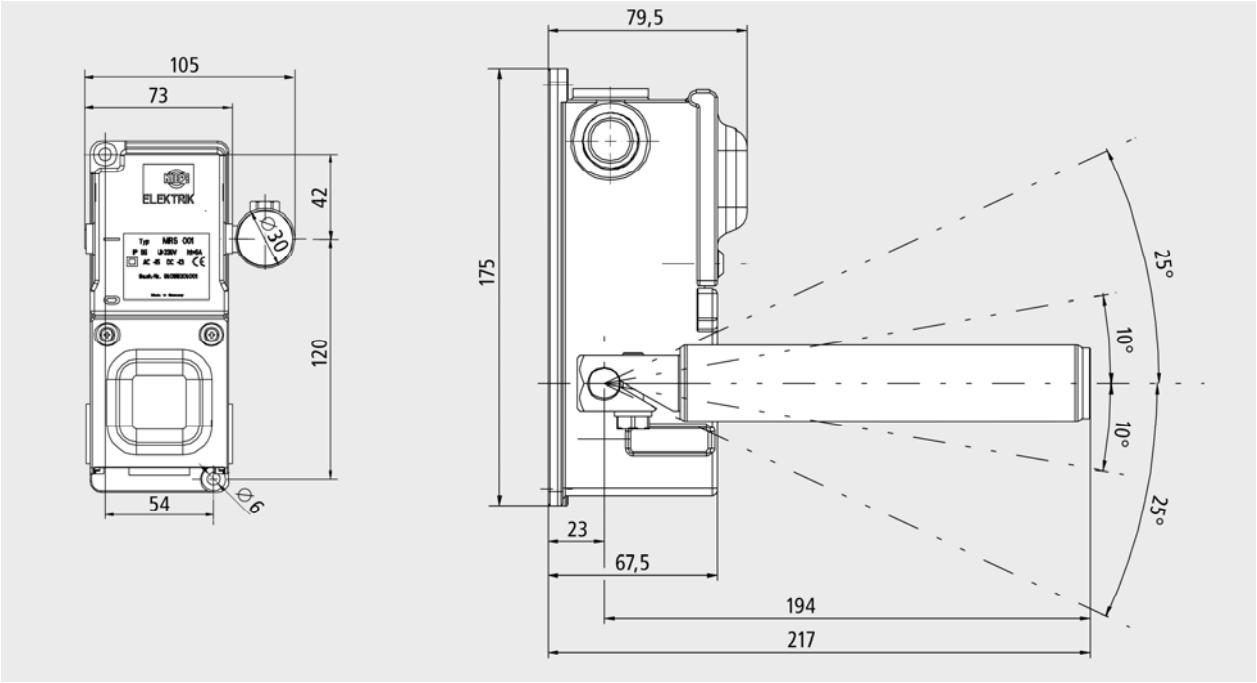


Figure 11. Belt wander switch type BWS1 dimensions

32. BELT WANDER SWITCH TYPE BWS2

The belt wander switch type BWS2 is typically suspended in such a way that the belt edge just runs past the body of the wander switch. If the belt should wander or move laterally the edge of the conveyor belt material will begin to touch the body of the BWS2, causing it to deflect and tilt causing the internal switch of the BWS2 to operate. The BWS2 is protected from damage as it can swing out of the way.

Photograph 25. Belt wander switch type BWS2

The BWS21 may contain any of the Dupline single channel digital transmitters or alternatively be wired to the input of a transmitter in a nearby enclosure.

33. BELT MAN OVERIDE SWITCH TYPE BMOS1

The belt man override switch type BMOS1 is designed to be installed over the conveyor in such a way that the trip wire is not activated by uneven material distribution on the belt but is tripped by a man riding the conveyor. The BMOS1 may contain any of the Dupline single channel digital transmitters or alternatively be wired to the input of a digital transmitter in a nearby enclosure.

Photograph 26. Belt man override switch type BMOS1

Photograph 27. Separated trip wire couplings used with the BMOS1

34. BELT TEAR (RIP) SWITCH TYPE BTS1

The belt tear or rip switch type BTS1 is used to detect conveyor belt tears or rips and is installed as shown in figure 28 below

Photograph 28. Belt tear or rip switch type BTS1

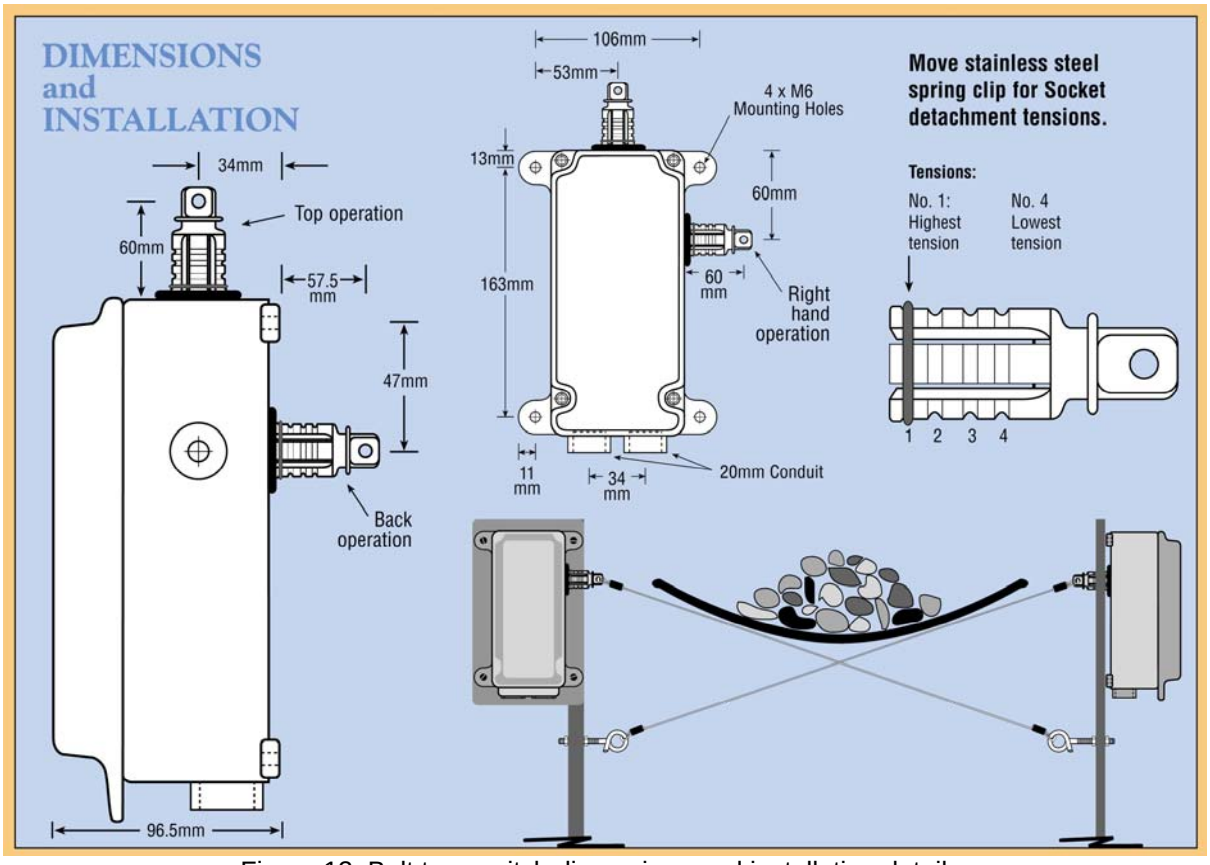
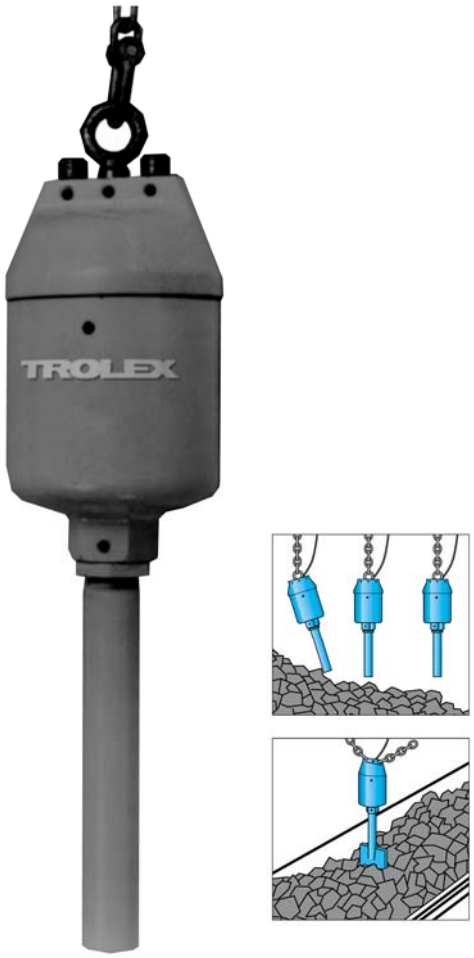


Figure 12. Belt tear switch dimensions and installation detail

35. BELT BLOCKED CHUTE SWITCH TYPE BBCS1

The belt blocked chute switch type BBCS1 is suspended in such a way that if material such as coal is to accumulate as a result of a blocked chute or blocked transfer point the switch is tilted causing the internal switch to activate. The BBCS1 may contain any of the Dupline single channel digital transmitters or alternatively be wired to the input of a digital transmitter in a nearby enclosure.



Photograph 29. Blocked chute switch type BBCS1

36. CABLING AND INSTALLATION

Dupline uses a twisted pair communication cable that can be routed in any direction and any configuration using common “off the shelf” cables provided that a few simple rules are followed:

- Use cables with greatest cross sectional area to achieve maximum transmission distance.
- Use cables with lowest capacitance to achieve maximum transmission distance.
- Use un-shielded cables to lower capacitance and increase transmission distance.
- Shielded cable may be required in high noise environments.
- Cables employing low dielectric constant insulation can achieve lower capacitance and therefore greater transmission distance.
- If the cable has a screen or shield for noise immunity or explosion protection requirements then it must be continuous and earthed at one location only, typically at the channel generator or at the barrier in I.S. installations. Also ensure that all un-used conductors are continuous and earthed at the same location as the screen.

- Use cables that are twisted pairs or use one twisted pair of a multi-core cable.
- Preferred cable 1.5mm^2 tinned copper conductors with a capacitance of less than 60pF/m.

The Dupline cable is a signal cable and therefore should be routed as such; it should be kept separate from power cables. It should also be kept away from high energy noise sources such as contactors and switched inductive loads.

Cable splices are often the source of problems. It is highly recommended to splice only cables of the same characteristics (cross sectional area, capacitance). The splicing contact resistance must be as low as possible. Long-term corrosion of the splicing contact should be considered. For shielded cable the shield must be continuous but must not be grounded at the splicing points.

Cable reflections are common in long transmission systems and transmission systems that have large spurs. Dupline is particularly immune to reflections due to its transmission speed. However reflections can occur and cause problems on the system. It is highly recommended that a DT01 termination unit terminate cable ends.

37. DEFINITIONS

INBOUND COMMUNICATIONS
The signal direction convention that indicates that the signal is originating at a remote field device and travelling towards the channel generator.

OUTBOUND COMMUNICATIONS
The signal direction convention that indicates that the signal originated at the channel generator and is travelling towards the field device.

SPLIT I/O
The uncoupling of inbound communications from outbound communications.

INBYE
Term used to describe a direction or location further into the hazardous area and in the case of Austdac conveyor systems further away from the channel generator.

OUTBYE
Term used to describe a direction or location further out of the hazardous area and in the case of Austdac conveyor systems closer to the channel generator.

38. ENCLOSURES

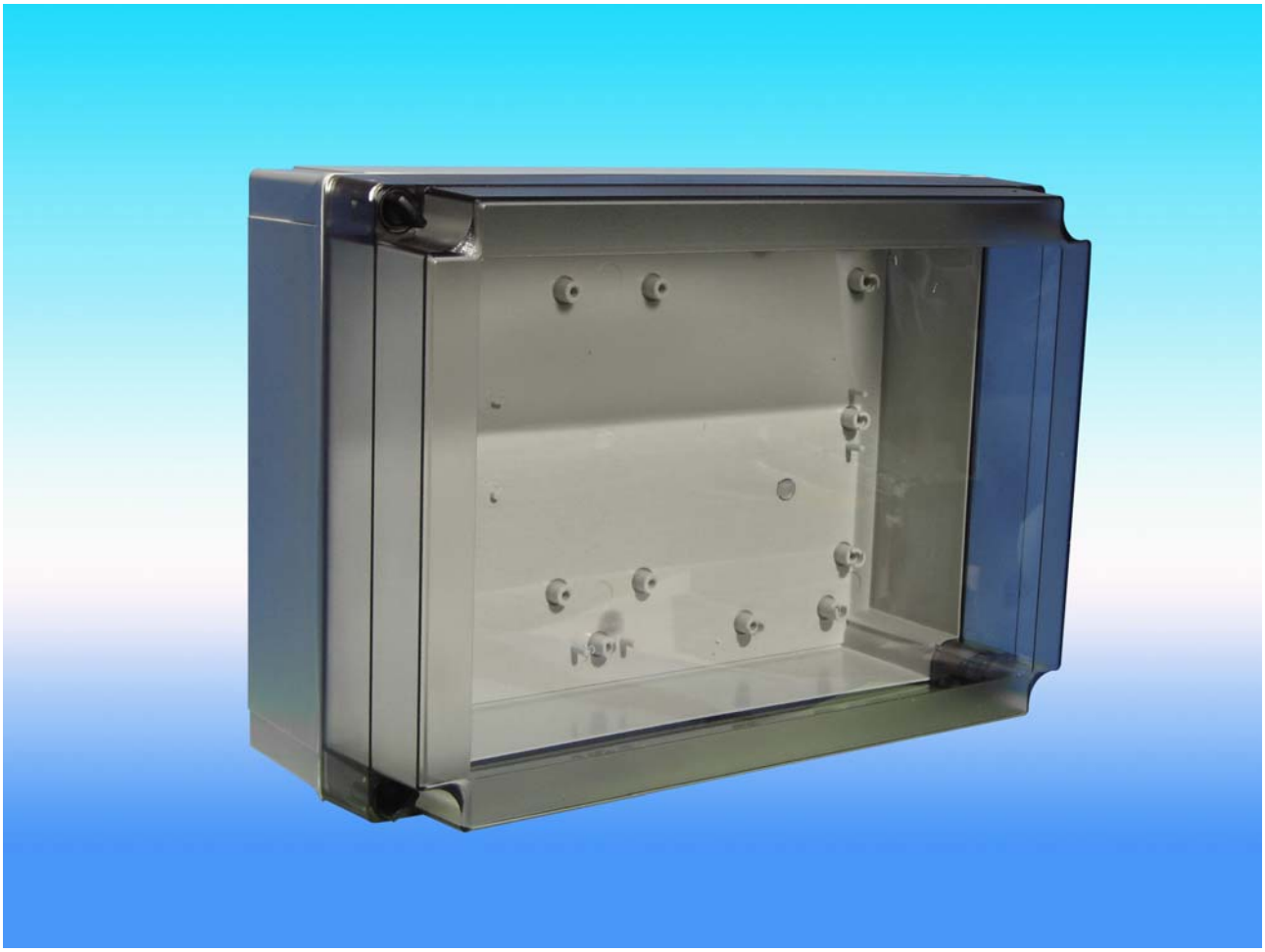
The Ex Dupline system consists of all the modules listed in table 2 of this document. These modules may be mounted in many certified enclosures suitable for various applications depending on the system and ingress protection required for the installation. The actual enclosure that any particular module is mounted within is dependant on agreement between Austdac, the end user and the certification body. Table 42 below shows the enclosures into which a module may be mounted.

Ex DUPLINE MODULE TO ENCLOSURE MATRIX					
#	MODULE NAME	MODULE TYPE	TYPE OF Ex PROTECTION PROVIDED BY ENCLOSURE	MINIMUM [#1] HOST ENCLOSURE INGRESS PROTECTION	ENCLOSURE TYPE
1	BELT CONTROLLER	8081	Exd	IP55	B&F FLAMEPROOF[#3]
			SAFE AREA	IP40	PC200
			SAFE AREA	IP66	TE3212/S
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
2	CHANNEL GENERATOR	DEX 3490 000 712	Exd	IP55	B&F FLAMEPROOF[#3]
			Exi	IP66	TE2212/S
			SAFE AREA	IP40	PC200
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
3	1 CH DIGITAL TRANSMITTER OR SAFETY TRANSMITTER	8023 SILBUS8161 SILBUS8150	Exd	IP55	B&F FLAMEPROOF[#3]
			Exi	IP66	TE2212/S
			Exi	IP55	PULLKEY ESS1
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
			Exi	IP65	LOCKOUT
			Exi	IP65	CADLOCK
4	8 CH DIGITAL TRANSMITTER	8084 SILBUS8163	Exd	IP55	B&F FLAMEPROOF[#3]
			Exi	IP66	TE2212/S
			Exi	IP55	PULLKEY ESS1
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
			Exi	IP65	LOCKOUT
			Exi	IP65	CADLOCK
5	4 CH DIGITAL RECEIVER	ARX4D	Exd	IP55	B&F FLAMEPROOF[#3]
			Exi	IP66	TE2212/S
			Exi	IP66	TE3212/S
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
6	1 CH ANALOGUE TRANSMITTER	G3210 1161	Exd	IP55	B&F FLAMEPROOF[#3]
			Exi	IP66	TE2212/S
			Exi	IP66	TE3212/S
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
7	4 CH ANALOGUE TRANSMITTER	ATX4A	Exd	IP55	B&F FLAMEPROOF[#3]
			Exi	IP66	TE2212/S
			Exi	IP66	TE3212/S
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
8	8 CH ANALOGUE RECEIVER	ARX8A	Exd	IP55	B&F FLAMEPROOF[#3]
			Exi	IP66	TE2212/S
			Exi	IP66	TE3212/S
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
9	1 CH TEMPERATURE TRANSMITTER	G3210 1112	Exd	IP55	B&F FLAMEPROOF[#3]
			Exi	IP66	TE2212/S
			Exi	IP66	TE3212/S
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
10	ZENER LIMITER	AEL1	Exd	IP55	B&F FLAMEPROOF[#3]
			SAFE AREA	IP66	TE3212/S
			SAFE AREA	IP66	TE2212/S
			SAFE AREA	IP40	PC200
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]

11	BARRIER	Z960	Exd	IP55	B&F FLAMEPROOF[#3]
			SAFE AREA	IP66	TE3212/S
			SAFE AREA	IP66	TE2212/S
			SAFE AREA	IP40	PC200
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
12	TERMINATION UNIT	DT01	Exd	IP55	B&F FLAMEPROOF[#3]
			SAFE AREA	IP66	TE3212/S
			SAFE AREA	IP66	TE2212/S
			SAFE AREA	IP40	PC200
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]
13	TEST UNIT	GTU8	Exi	IP55	LEATHER CASE[#2]
14	PROGRAMMER	GAP1605	Exi	IP55	LEATHER CASE[#2]
15	REPEATER	A2WCCT1	Exd	IP55	B&F FLAMEPROOF[#3]
			Exi	IP66	TE3212/S
			Exi	IP66	TE2212/S
			SAFE AREA	IP40	PC200
			SAFE AREA	IP55 / 66[#4]	CONTROL PANEL[#1]

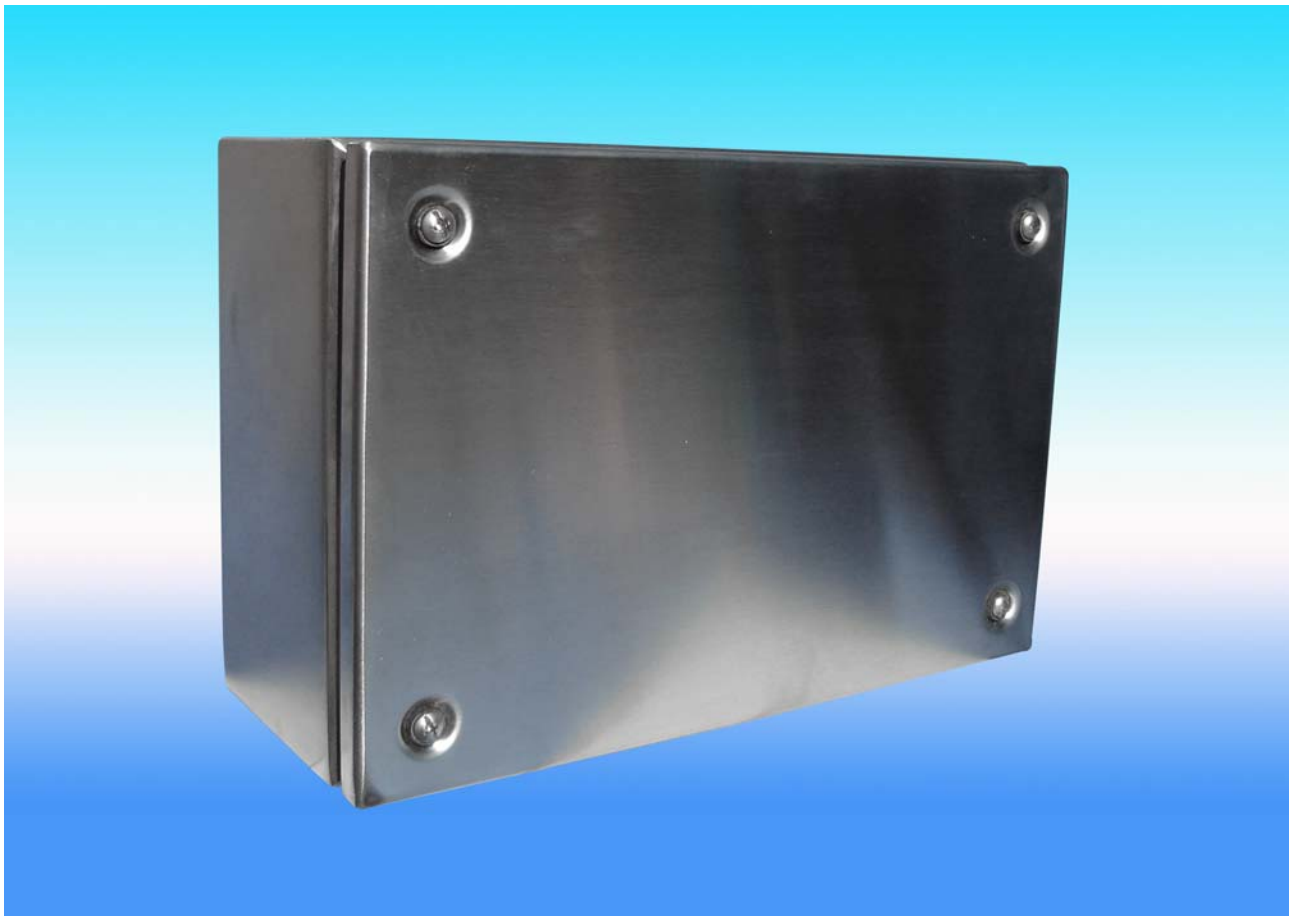
NOTES:
1 ANY SUITABLY SIZED CONTROL PANEL ENCLOSURE. AGREEMENT REQUIRED BETWEEN AUSTDAC, END USER AND CERTIFICATION BODY.
2 MODULE MUST NOT BE REMOVED FROM LEATHER CASE WHEN IN HAZARDOUS AREA OR UNDERGROUND.
3 ANY SUITABLY SIZED Exd ENCLOSURE. AGREEMENT REQUIRED BETWEEN B&F, END USER AND CERTIFICATION BODY.
4 INGRESS PROTECTION TO SUIT INSTALLATION ENVIRONMENT. AGREEMENT REQUIRED BETWEEN AUSTDAC, END USER AND CERTIFICATION BODY.

Table 42. Ex Dupline Module to Enclosure Matrix

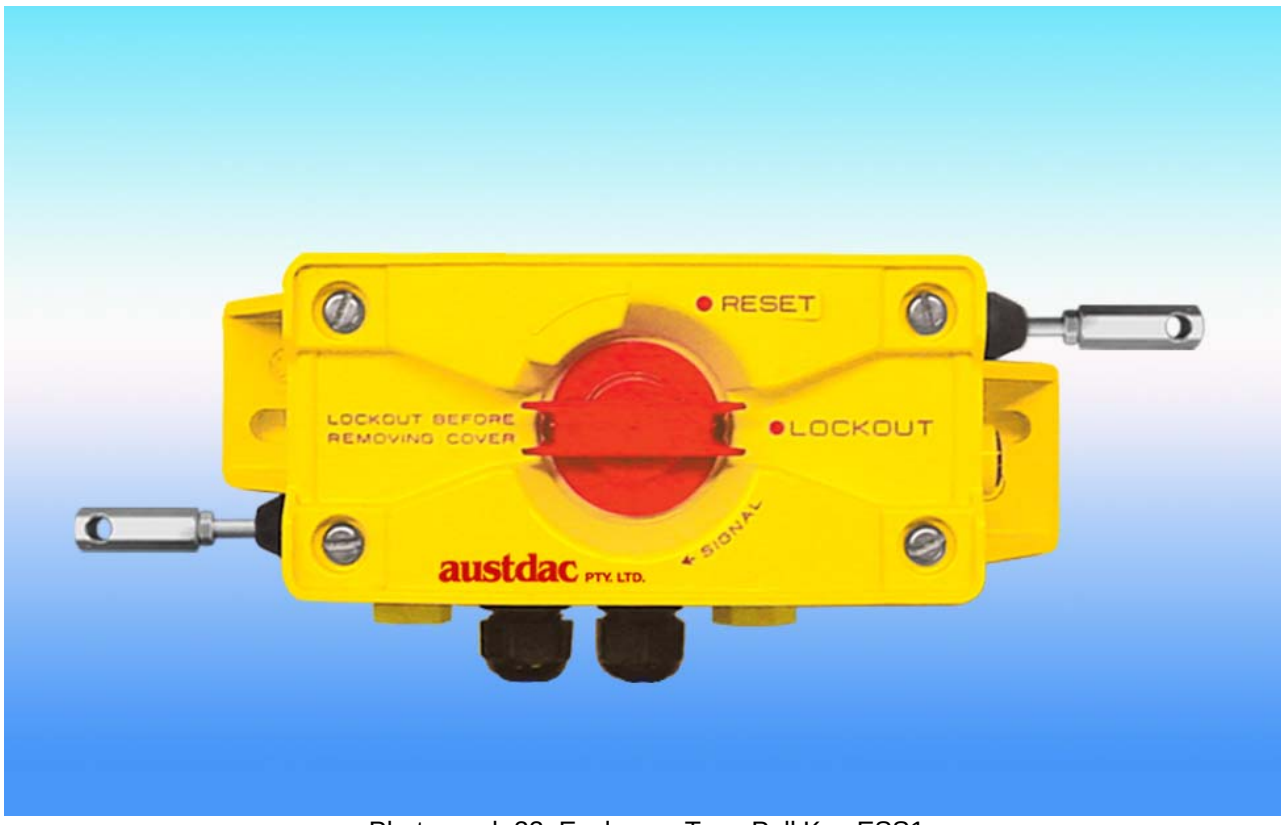


Photograph 30. Enclosure Type PC200

Photograph 31. Enclosure Type TE2212/S

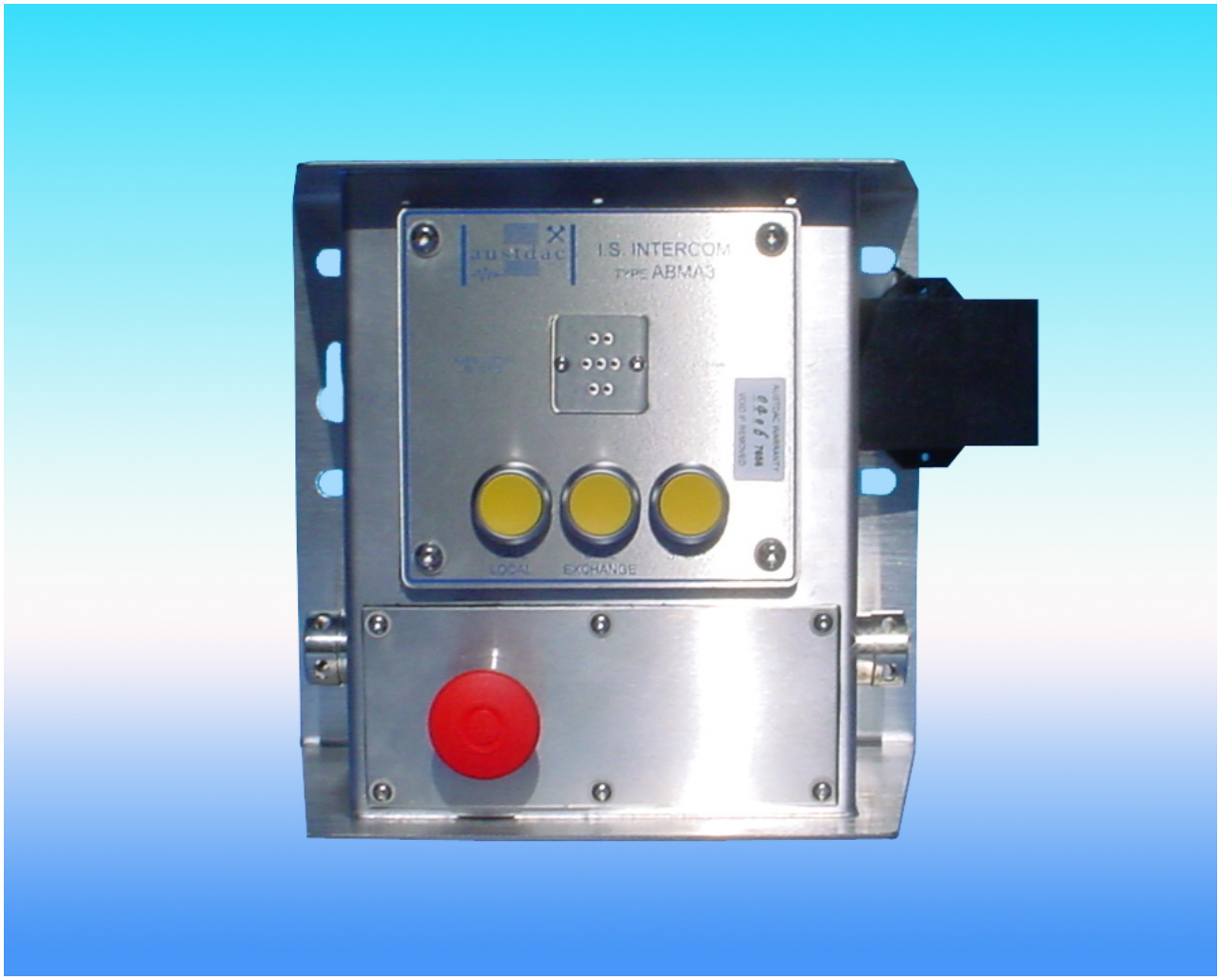


Photograph 32. Enclosure Type TE3212/S



Photograph 33. Enclosure Type Pull Key ESS1

Photograph 34. Enclosure Type Lockout



Photograph 35. Enclosure Type Cadlock

39. ENCLOSURE CABLE ENTRIES

The enclosure types listed in table 43 below may be fitted with plastic or metal glands as required. The IP rating of the gland shall match the operating environment. In some cases the gland may be replaced with a slip ring connector. Maximum gland size is 25mm for all enclosures except the control panel where 32mm glands are allowed.

ENCLOSURE CABLE GLAND INFORMATION					
ENCLOSURE	ENTRIES PER LONG SIDE	ENTRIES PER SHORT SIDE	PLASTIC GLAND[#3] Exi OR EExi [#1 #2]	METAL GLAND Exi OR EExi [#1 #2]	PLUG AND SOCKET
PC200	4	3	YES	NO	NO
TE2212/S	3	3	YES	YES	SLIP RING
TE3212/S	4	3	YES	YES	SLIP RING
PULL KEY ESS1	-	-	YES	NO	NO
LOCKOUT	2	2	YES	YES	NO
CADLOCK			YES	YES	SLIP RING
CONTROL PANEL	AS REQUIRED	AS REQUIRED	YES	YES	SLIP RING

NOTES:
#1 GLANDS MUST BE LABELLED Exi OR EExi FOR USE IN RUSSIA
#2 IP RATING OF GLAND SHALL MATCH THAT OF ENCLOSURE SEE TABLE 42
#3 THE USE OF PLASTIC GLANDS IN RUSSIA SHALL BE AGREED BETWEEN END USER, CERTIFICATION BODY AND AUSTDAC.

Table 43. Enclosure Cable Gland Information

40. CERTIFICATION

The Dupline system is certified for use in group I hazardous areas. The system has been awarded Australian (AUS Ex 3480X) and international (IEC Ex TSA TR24858) certification and assessment test reports. The Dupline family consists of many modules, only those modules listed on the certificate schedule are certified for use in group I hazardous areas.
Figure 11 shows various certified and approved examples of connecting the Dupline two or three wire network located in the hazardous area to the channel generator located in the safe area.

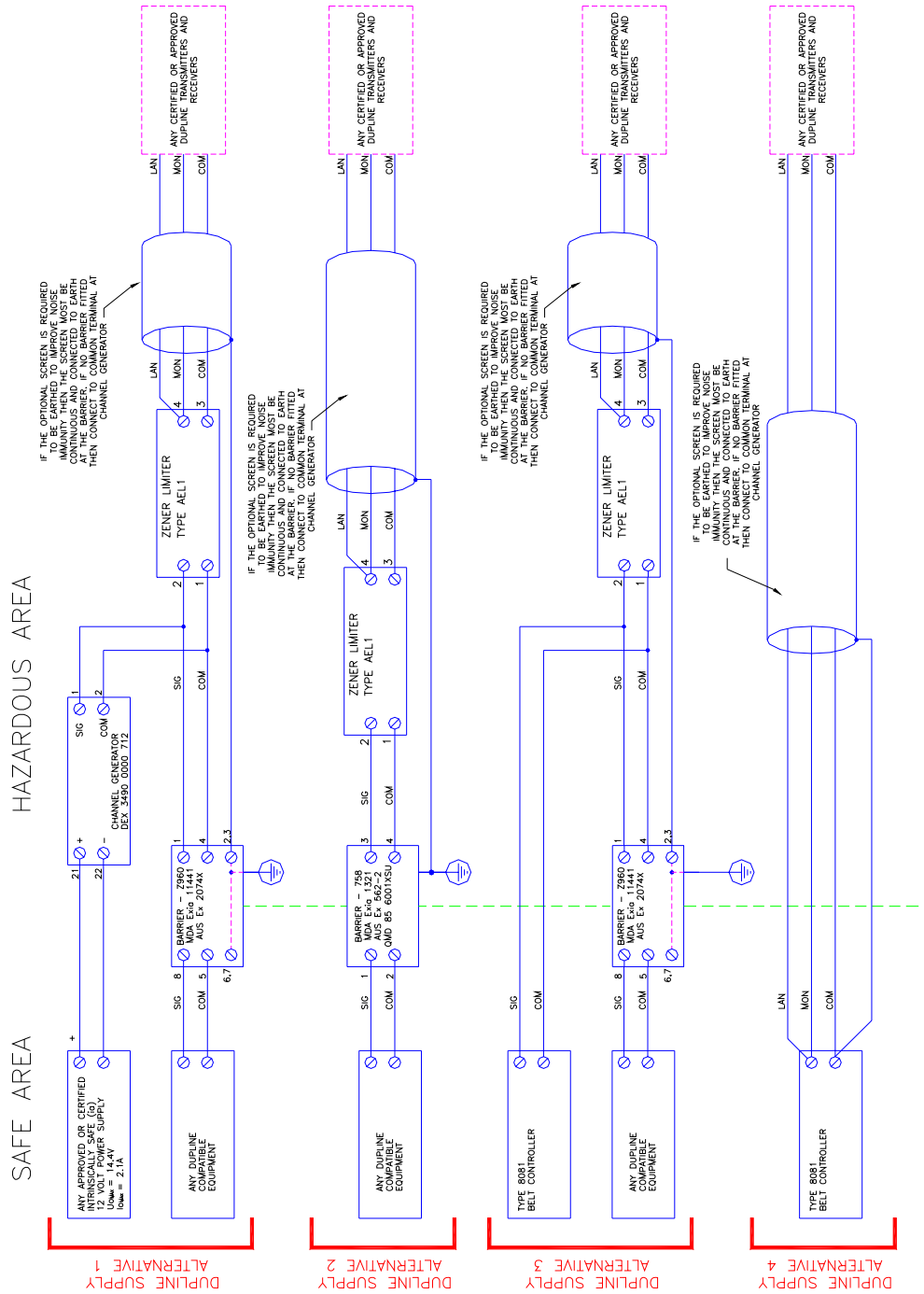


Figure 13. Dupline Certification and System Connection Details (Generators)

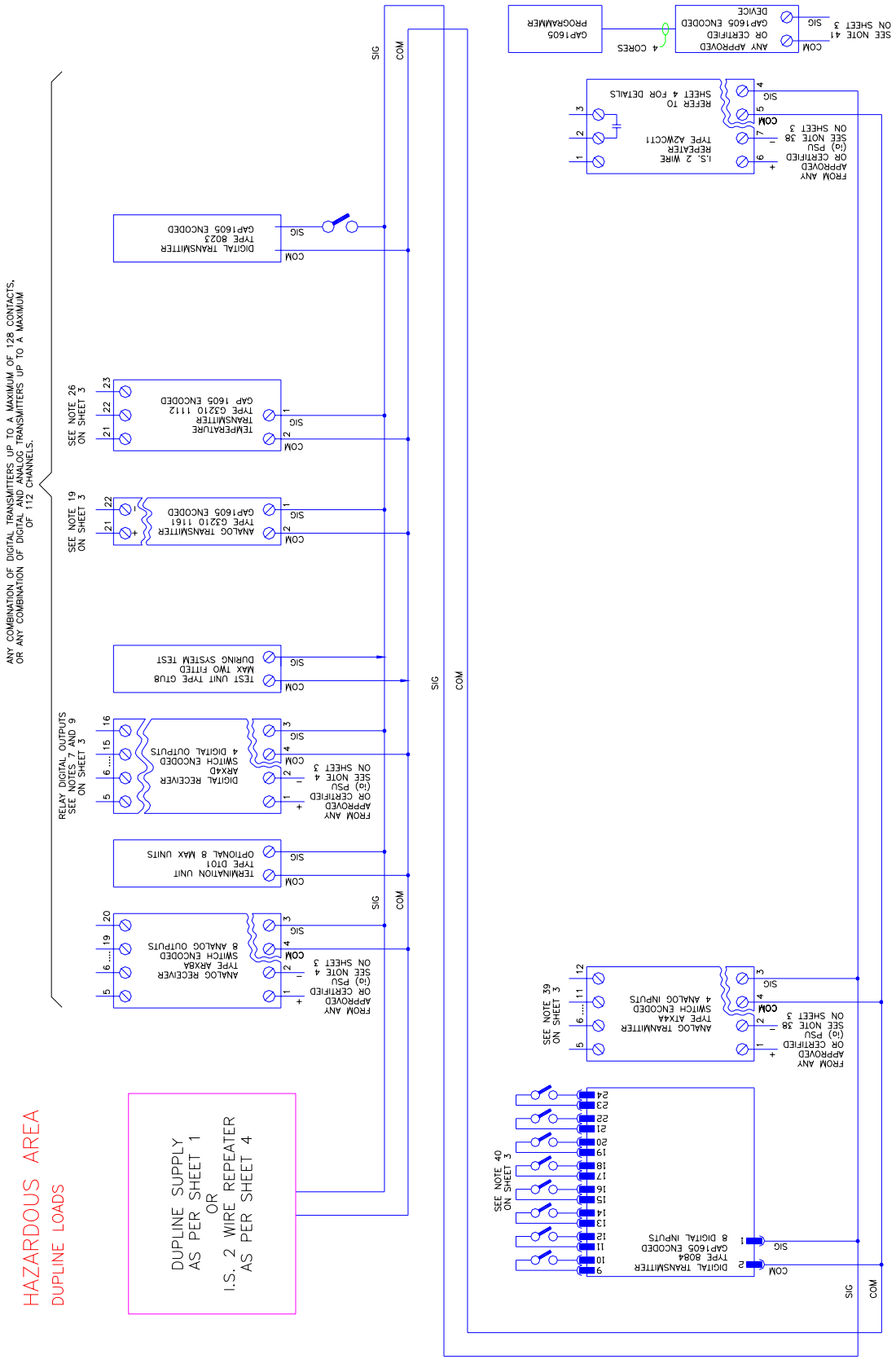


Figure 14. Dupline Certification and System Connection Details (I/O modules)

Figure 15. Dupline Certification and System Connection Details (Notes)

NOTES:

1. I.S. power supply wiring in safe area must be segregated from non I.S. wiring in accordance with AS2380.7 clause 2.8.
2. The barrier must be earthed in accordance with AS2380.7 clause 2.7.
3. The wiring of the Dupline system in hazardous areas shall be in accordance with AS2380.7 clause 2.9.
4. ARX8A and ARX4D may be powered from any approved or certified power supply with the following output parameters Uo = 14.4V, Io = 2.1A, Co > 1.5uF and Lo > 20uH.
5. All single channel digital transmitters may have as an option the contact input permanently shorted out and the monitored contact placed in series with the signal line of the transmitter.
6. Up to 14 receivers type ARX8A and up to 16 receivers type ARX4D may be placed on the Dupline signal pair.
7. The outputs of digital receiver type ARX4D may be used for switching seperately approved I.S. circuits having a source potential not exceeding 25 volts. This power source may be the same as the power source used to power the receiver.
8. Digital receiver type ARX4D is switch encoded. Encoding may be carried out in hazardous area.
9. The relay outputs of digital receiver type ARX4D may be used to switch safe area circuits up to 250Vrms 1A maximum when the receiver is located in a safe area.
10. Transmitter types 8023 and G3210 1161 are GAP1605 encoded. Encoding may NOT be carried out in a hazardous area.
11. Barrier type Z960 and 758 may be substituted with each other, or any approved / certified barrier with identical or more safe parameters.
12. Up to 8 termination unit type DT01 may optionally be fitted to the Dupline signal pair.
13. The termination unit type DT01 may be substituted with the zener diode and resistor network shown on sheet 4.
14. Up to 2 test units type GTU8 may be connected to the Dupline signal pair in the hazardous area.
15. The channel generator type DEX 3490 0000 712 must be modified in accordance with drawings 76-02-03 sheet 2, 76-00-3-07 sheet 2 and 76-03-07 sheet 5 to comply with AS2380.7.
16. The capacitance and inductance (L/R) ratio of any cable used with the system shall not exceed the values specified for the particular I.S. power supply being used to power the dupline system.
17. DEX 3490 000 712 may be powered from any approved or certified I.S. power supply having a maximum source potential not exceeding 14.4V DC and source current not exceeding 2.1A.
18. The Dupline system may be constructed using spurs in the cabling, provided that the requirements of note 16 above are met and that signal transmission effects are taken into account.
19. The 4-20mA input of analog transmitter type G3210 1161 may be derived from any approved / certified I.S. equipment with Uo = 15.4V, Io = 100mA, Co > 1.5uF and Lo > 20uH.
20. The ragged lines on sheets 1 and 2 of drawing 76-001-19 indicate opto or relay isolation.
21. Test units type GTU8 and programmer type GAP1605 must be within their leather cases when in use and when in a hazardous area.
22. All controllers / transmitters / receivers must be mounted within an approved / certified antistatic plastic or metal enclosure providing a minimum protection rating of IP55.
23. No alloys of aluminium, titanium or magnesium used in construction of Dupline equipment.
24. All SMD resistors 5%, all thru-hole resistors 10%, all tantalum capacitors 20%, all MKS capacitors 20%, all Z5U ceramic 20%, all X7R ceramic 20%, all electrolytic radial 20%, all electrolytic axial 50%, all inductors 10% tolerance unless otherwise stated.
25.
26. Connected to any simple apparatus. Installed in accordance with AS2380.7 clauses 2.8.1, 2.8.2, 2.8.4, 2.9.3 & 2.9.4
27. The three wire alternative shown on sheet 4, depicts only digital transmitters, any type of approved Dupline compatible transmitter or receiver may be optionally fitted to the system.
28. Limitations listed as per sheets 1,2 & 3 shall apply.
29. Normally open or normally closed switches may be used.
30. R1 and D1 OR DT01(s) are optionaly fitted to reduce line reflections.
31. R1 has a resistance of between 33 and 100 ohms.
32. R1 is a 3 Watt minimum film type resistor.
33. D1 is a 5 Watt 6.2 Volt zener type 1N5341B or equivalent.
34. R1 and D1 are mounted within an enclosure with a minimum rating of IP55.
35. All switches and tranmitters are mounted in host enclosures with a minimum rating of IP55.
36. Maximum length of 3 wire Dupline system is 8000 metres.
37. Four and five wire Dupline systems may be constructed with maximum lengths of 8000 metres.
38. ATX4A and A2WCCT1 may be powered from any approved or certified power supply with the output paramters Uo = 16.5V, Io = 2.35A, Co > 1.5uF and Lo > 20uH.
39. 4-20mA analog input from source with Uo max = 16.5V and Io max = 2.37A. Output of ATX4A are Uo max = 7.14V, Io max = 3.6mA, Co max = 22uF, Lo max = 100uH and Lo/Ro = 73mH/OHM
40. 8084 input may be switched from voltage free contacts or infallibly rated voltage free opto coupler
    Output of 8084 are Uo max = 10.35V, Io max = 1.1mA, Co max = 22uF, Lo max = 100uH and Lo/Ro = 73mH/OHM
41. GAP 1605 encoded devices must be removed from the dupline signal pair before connection to the GAP 1605 programmer.
42. Type 8081 Belt Controller requires a Zener Limiter Type AEL1 when a barrier Type Z960 or 758 is connected to the Dupline signal pair.
43. VREG (WHITE) and SCLK (BLACK) wires connected to GND wire when 8023 connected to dupline signal pair.

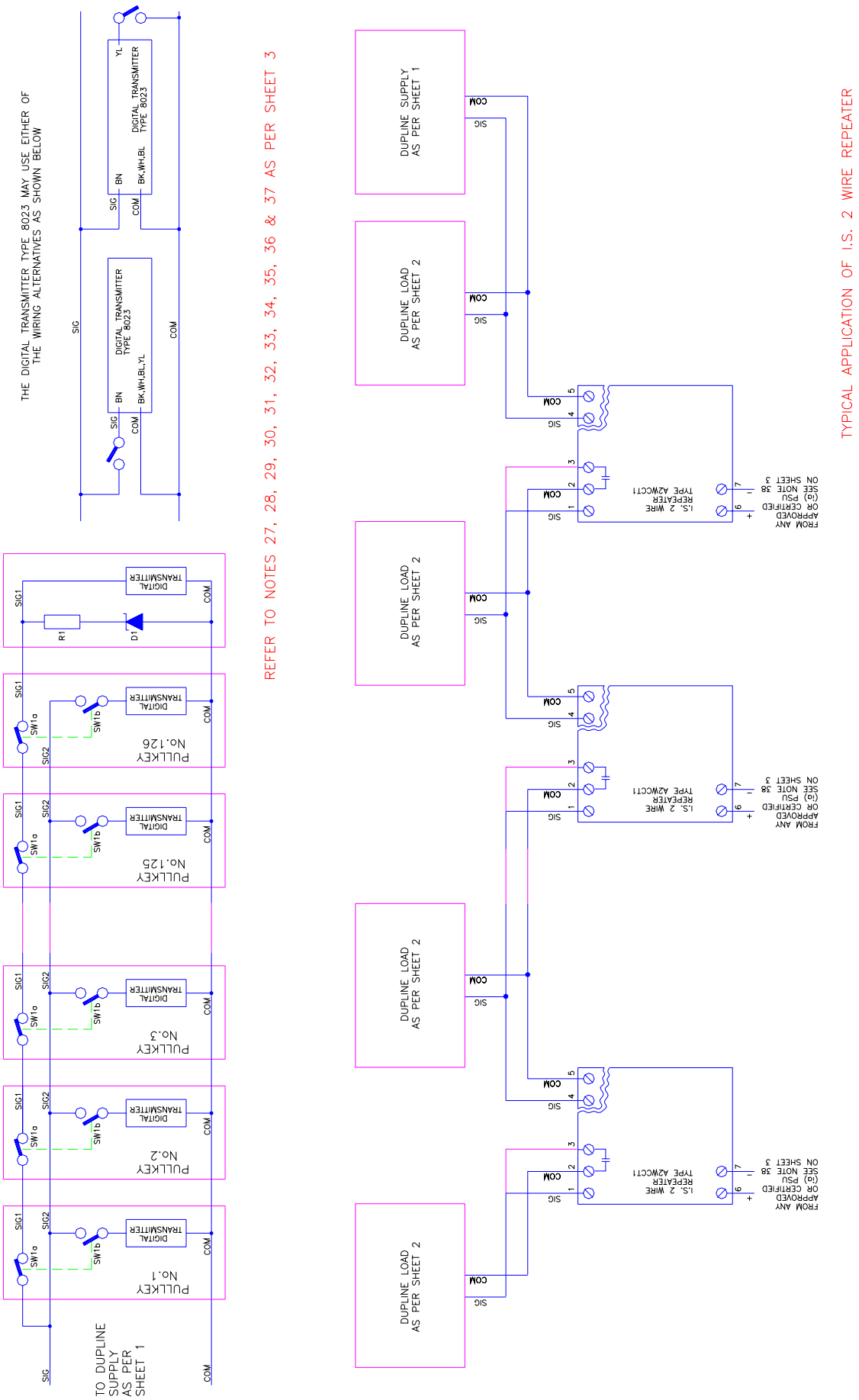


Figure 16. Dupline Certification and System Connection Details (Repeaters)

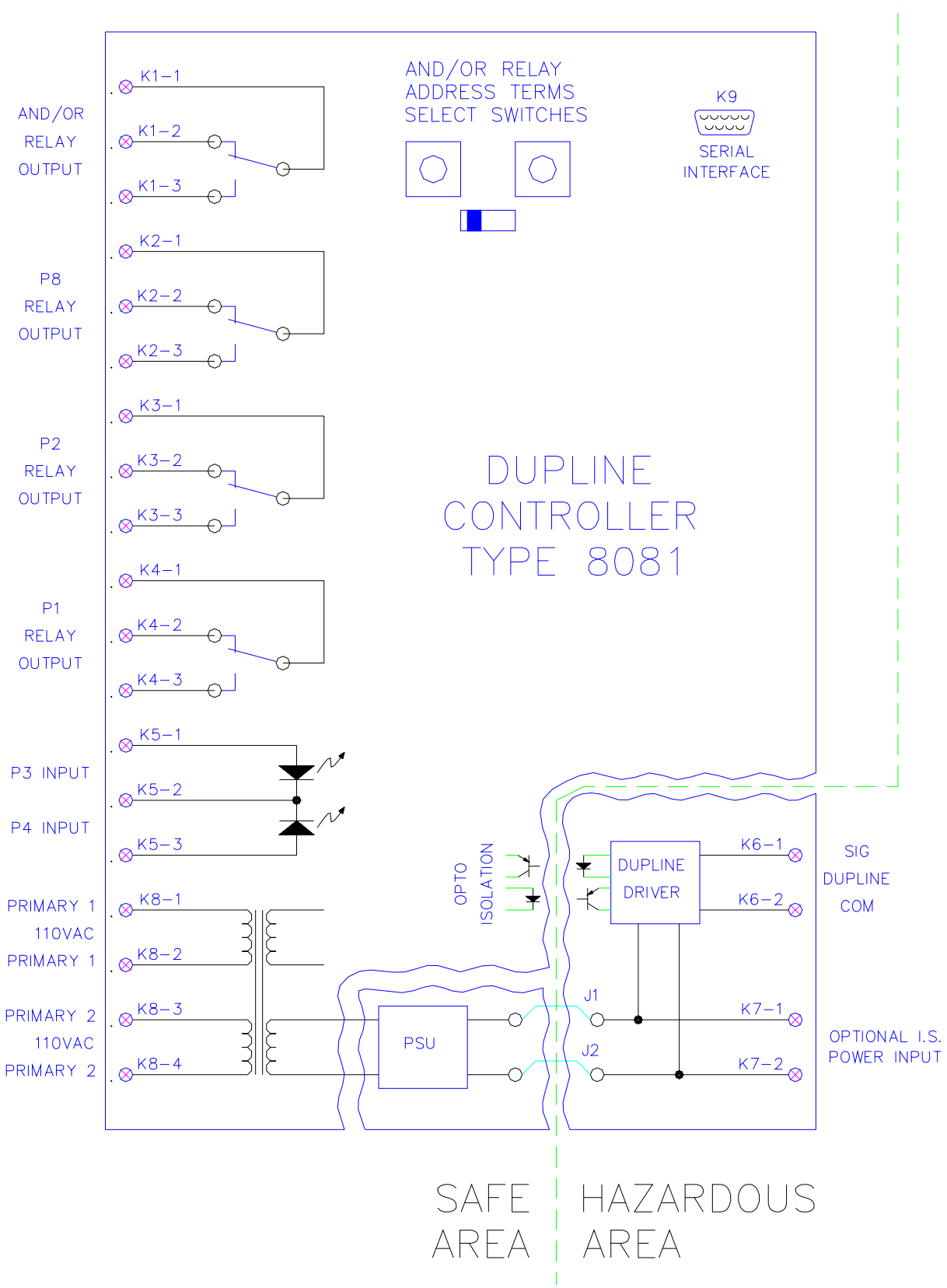
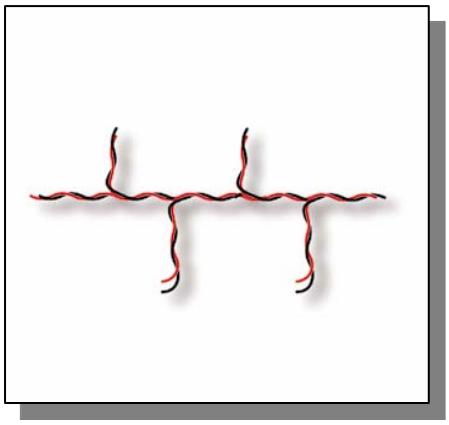


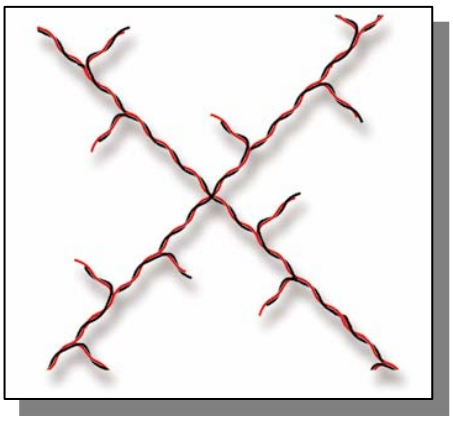
Figure 17. Dupline Certification and System Connection Details (8081 Segregation)

41. CABLE TOPOLOGY

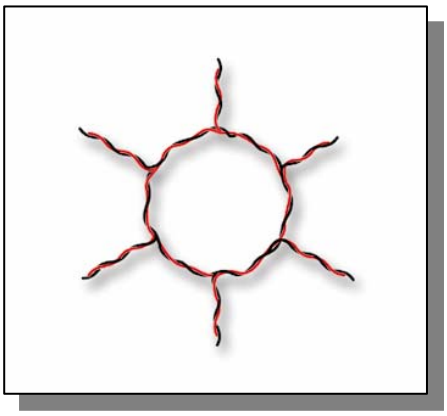
There are no restrictions for the routing of the Dupline cable. Line, star, ring or combination topologies can be implemented. A branch can be made at any point in the system and there is no restriction on the length except for the limitation in total transmission distance. Free topology is an important feature for e.g. alarm, security and building automation applications, since the "routing" of gangways, stairs, and rooms in a building represents a "free topology".



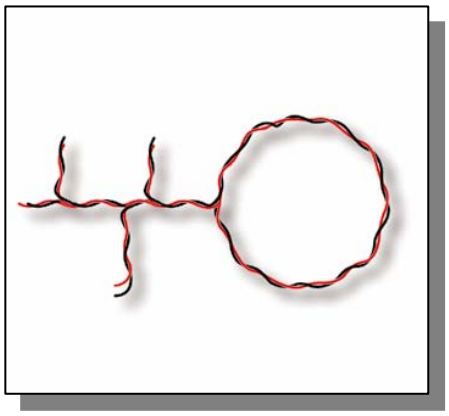
Line Configuration



Star Configuration



Ring Configuration



Combined Configuration

Figure 18 Typical topologies of Dupline two wire networks

Some installations such as the Austdac conveyor control and monitoring system requires three wires in the Dupline network to achieve the best solution for the application. The additional wire is also a signal line that shares the common line. Such applications are possible only with careful management of the cable capacitance. The additional signal line is required to achieve compliance with AS1755.

42. THREE WIRE CONVEYOR SYSTEM PRINCIPLE OF OPERATION

Figure 19 shows the basic principle of operation of the Austdac standard three-wire conveyor monitoring system. This arrangement ensures compliance with AS1755, maximum coverage distance and information about the installation. The main feature of this type of installation is the two signal lines referred to as ‘lanyard’ and ‘monitor’. The installation consists of a Dupline transmitter in each pullkey and two transmitters at the tail or boot end. The switch positions are shown in a belt running or “non emergency stop” situation.

The lanyard line passes down the pullwire cable feeding in and out of normally closed switches in each pullkey before being finally feed into the end of line transmitter. The end of line transmitter is always active and can be “seen” by the system controller provided that all the inline switches are closed and the lanyard cable is in tact. This part of the circuit forms the primary safety control loop of the conveyor control system. Should a switch, cable, connection or transmitter fail then the end of line transmitter will not be visible at the system controller resulting in the power to the belt being shut off. Power to the conveyor would be cut if any of the switches were operated (opened) in an emergency.

The monitor line also makes its way along the lanyard cable finally ending with another transmitter in the ‘end of line’ unit. The monitor line is used to pick up location transmitter signals and return them to the controller. Location transmitters allow the system controller to identify the location of an active emergency stop. Each location transmitter is coded with a unique address starting at Dupline address A1 and consuming each consecutive address until all pullkeys are identified.

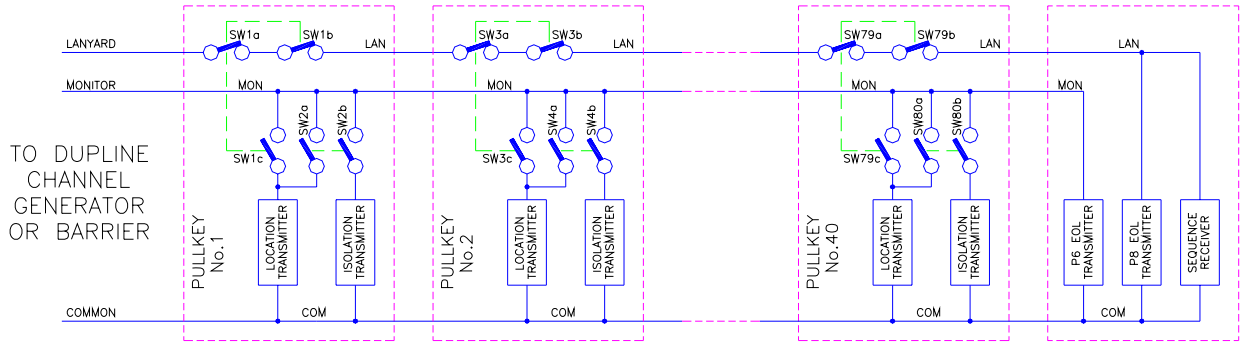


Figure 19. Typical Austdac Three Wire Conveyor Schematic

The system controller is configured with all the addresses of the location transmitters such that if any one of the location transmitters is active then power to the conveyor will be shut off. This ORing of the location transmitters is the secondary or backup safety control loop of the conveyor controller. The unique address of the location transmitter is also used to indicate the location of the emergency stop.

A further transmitter, called the isolation transmitter, may be located in each pullkey to stop and remove power from the belt for maintenance purposes. All isolation transmitters are coded to the same address. The isolation switch can be wired to activate the location transmitter as well, thus providing the location of a remote isolation. Should the monitor line be broken for any reason, then the EOL transmitter at the end of the monitoring line would not be seen by the controller, resulting once again in power to the conveyor being shut off.

If the conveyor control system is on a belt that forms part of a chain of belts then belt sequencing will be required. Sequencing stops inbye belts from dumping material onto halted outbye belts. If sequencing is required then a digital receiver would be placed in the end of line unit on the lanyard line. A closed contact at the receiver would indicate belt running and would be used by an inbye conveyor controller to allow the inbye belt to run.

43. TWO WIRE CONVEYOR SYSTEM PRINCIPLE OF OPERATION

Figure 20 shows the basic principle of operation of the Austdac standard two-wire conveyor monitoring and control system. This arrangement ensures compliance with AS1755, minimum complexity and cable usage and maximum information about the installation. The main feature of this type of installation is the single pair of wires used to connect all field devices together.

Each pullkey contains two transmitters one permanently connected to the signal pair and visible to the controller, the other not connected to the signal pair and therefore not visible to the controller. The visible or 'AND' transmitters have unique sequentially coded addresses while the non-active or 'OR' transmitters are all coded with the same address. The transmitters are switched by different contacts on the same switch.

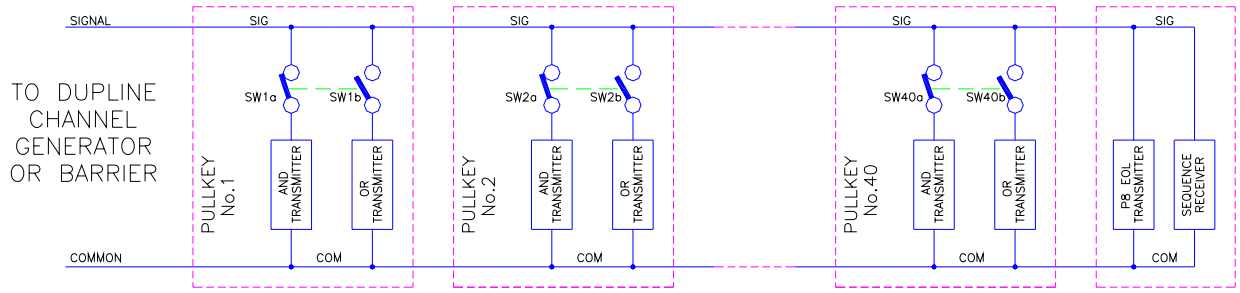


Figure 20. Typical Austdac Two Wire Conveyor Schematic

If any one of the AND transmitters is turned off then the controller will stop the belt. If any one of the OR transmitters is visible by the controller then the belt is stopped. It is this duplication of signalling that provides the Austdac two-wire Dupline conveyor control system with redundancy to comply with AS1755. The integrity of the signal line is monitored by the EOL transmitter located in the end of line unit. Should the signal line be broken the controller will no longer be able to see the EOL transmitter and shut down the conveyor immediately.

The controller can with the aid of the AND transmitters provide exact location information to the host PLC or control centre.

If the conveyor control system is on a belt that forms part of a chain of belts then belt sequencing will be required. Sequencing stops inbye belts from dumping material onto halted outbye belts. If sequencing is required then a digital receiver would be placed in the end of line unit on the signal line. A closed contact at the receiver would indicate belt running and would be used by an inbye conveyor controller to allow the inbye belt to run.

44. RECOMMENDED SWITCH DEVICES OR CONTACTS

The switch and relay contacts that are to be monitored by the Dupline system actually form part of the greater system and therefore will have an impact on overall system reliability. Particular attention should be paid to the selection of these contact and switch devices to ensure that they do not suffer from oxide build up between the contacts. This is of special concern when monitoring contacts with Dupline network powered digital transmitters as these devices sense the contact position with low voltages and currents. There may not be enough energy to break through the oxide and get a reliable contact, resulting in false or intermittent readings.

Gold plated contacts may not be enough unless they are bifurcated and employ some sort of mechanical contact wiping operation. Contacts that incorporate oxide-cleaning mechanisms such as wiping contacts are suitable.

Externally powered transmitters may employ voltages higher than 24 volts for sensing the status of contacts. Contacts with voltages above 24 volts generally do not have problems with oxide build up.