Title

DISPLAY TRIP AMPLIFIER TYPE ABBD2

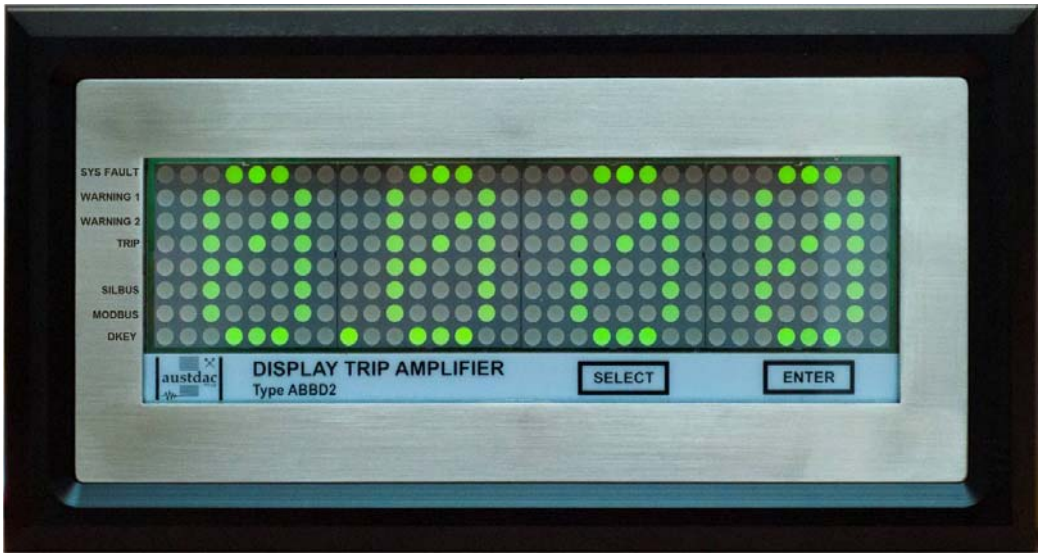
USER MANUAL

Document Number

13-337-12

Issue

05



REVISION CONTROL

05	Address and Logo Change	2017.04.07	CW	CW	PC
04	Update connection label	2016.10.17	JY	JY	PC
03	Section 7 Safety Functions	2016.04.08	JY	JY	PC
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1 GENERAL DESCRIPTION

The intrinsically safe, SIL2 Display Trip Amplifier Type ABBD2 is panel mounting large colour display that may also be used as a trip amplifier for local 4-20mA or as a outbye remote trip amplifier using Austdac SILBUS field bus network. The local or remote 4-20mA input is converted by the ABBD2 to display a gas levels (or any other levels e.g.. air flow) as a percentage or parts per million (ppm). The unit features a large 38mm high x 152mm wide three colour LED dot matrix display that can be easily viewed from 20 metres.

The trip amplifier section has three independent adjustable set point levels that alter the colour of the display and control the output relays. This means that as the input signal increases the display colour will change as the set point levels are exceeded. The changing of display colour allows the user to quickly determine process status at a glance, i.e. green for normal, yellow for warning 1, flashing between yellow and red for warning 2 and red for alarm. The display can also cater for falling alarms with display colour changing on decreasing input levels.

The display can accept up to two inputs of either a 4-20mA (or 0-20mA) current type or 0.4-2V (or 0-2V) voltage type. The user can select the type of input using console port. The display converts the input signal to one of many user configurable scales or ranges. All industry standard ranges or scales are configurable with any unique scales added at the factory by special request. The input is fully differential allowing for easy, noise free reliable operation.

The display can be user configured to accept the input signal from a SILBUS network (outbye system), thus allowing the ABBD2 to be used as a remote display with full trip amplifier set point operation. The SILBUS interface is fully compatible with the Analink® and Fastlink protocol and can auto detect 8, 16, 32, 64 or 128 channel networks. All of the set point alarms can be configured to transmit back onto the SILBUS network and provide remote tripping or control.

The display can be user configured to accept the local analogue inputs, display it and transmit the signal to the SILBUS network and MODBUS network along with the set point alarms as digital signals. In this mode, the ABBD2 can be used as a local display in a data acquisition or SCADA system. The analogue signal and set point digital signals can be independently configured to any valid SILBUS channel.

The ABBD2 has two models which are ABBD2-L (low power contact relay) and ABBD2-H (high power contact relay), there are three set point trip relays in the ABBD2 (one point for warning 1, one point for warning 2 and one point for trip1), one set spare point trip relay, each have voltage free contact available for connection to control circuits or pilot control circuits. In case of the trip, point two relays are allocated for SIL design requirements. These voltage free trip contacts may be used to switch safe area circuits provided that the unit is located in a safe area. The trip relay can be configured to latch until an optional “Deputy Key” is operated to unlatch the trip. The latch function is implemented using “permanent memory” which ensures that trips survive power outages and power cycling, an important feature when used with methane monitoring on continuous miners.

The ABBD2 is designed for SIL2 functional safety so the trip point has additional driven relay (i.e. two relays) which is wired in series and safe state the relay is energised (on).

Various system error and configuration error checking functions are incorporated within the ABBD2 to provide additional system safety and integrity to meet SIL2 assessment. These include the detection of “loss of input signal” errors from both the local analogue input and SILBUS. The configuration checking function detects SILBUS address clashes and set point sequence errors.

The display trip amplifier is supplied in a convenient panel mount enclosure providing ingress protection to IP66 when mounted in a suitably IP rated stainless steel enclosure (for example DWG: **13-363-14**). The display trip amplifier can also be provided within a stainless steel surface mounting enclosure suitable for direct mounting on a continuous miner or similar underground vehicle.

2 FRONT PANEL LAYOUT

The display trip amplifier ABBD2 front panel is shown in photograph 1 below, it is consist of the following item:

A 38mm high x 152mm wide three colour LED dot matrix display used to display text information such as the input value, configuration details, trip level, warning levels, SILBUS status, MODBUS status and relay status. All text information can be display as fix format when text is greater than four characters in scrolling format. The left most LED column is used to indicate ABDD2 status.

Photograph 1: ABBD2 front panel

3 REAR COVER

The rear cover of the type ABBD2 display trip amplifier contains all wiring connections and wiring information.

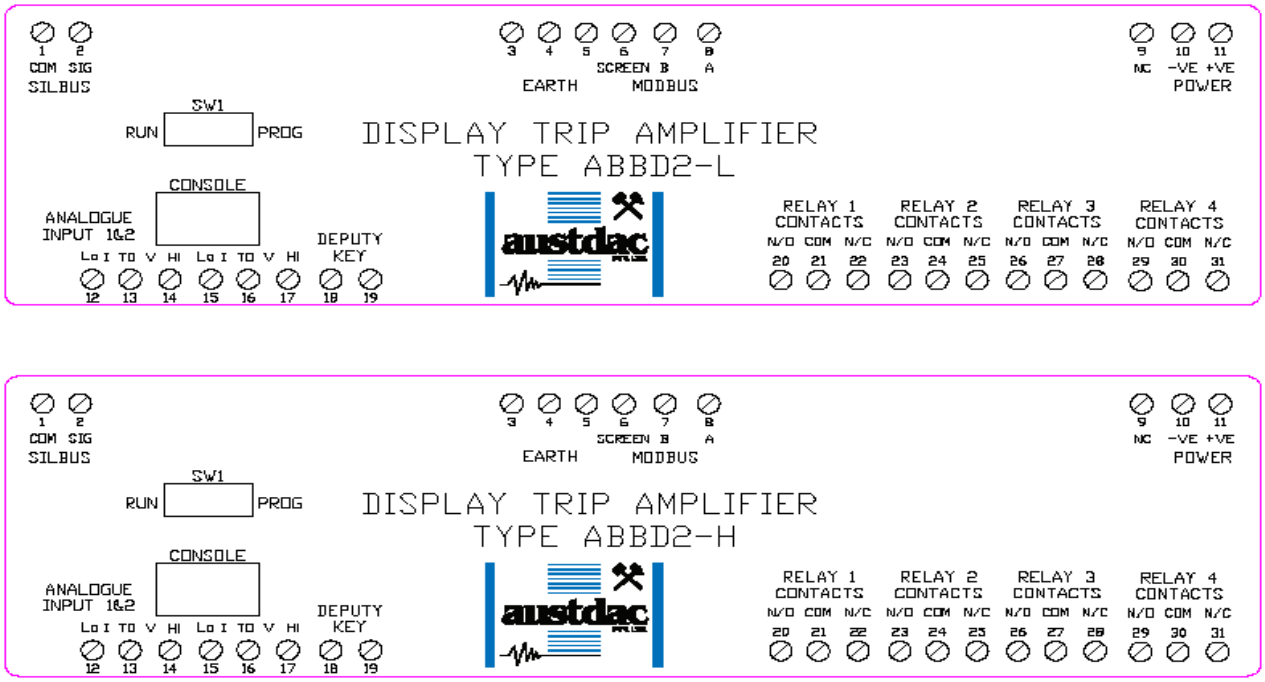
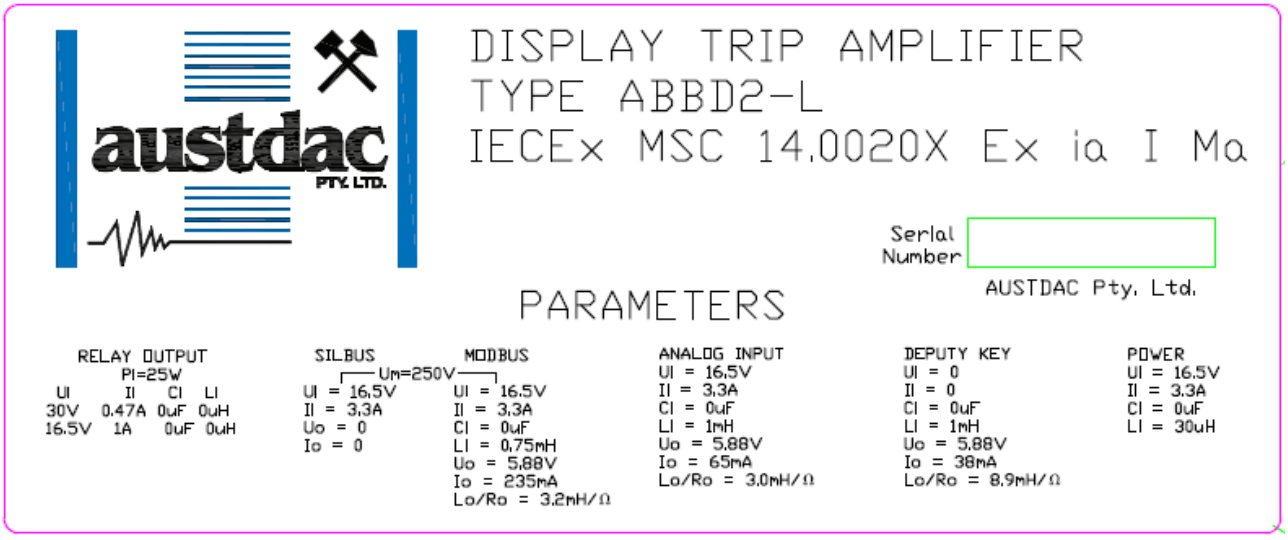


Figure 1 Rear cover label for ABBD2-L or ABBD2-H.

There is a certification label on the top of the display housing.



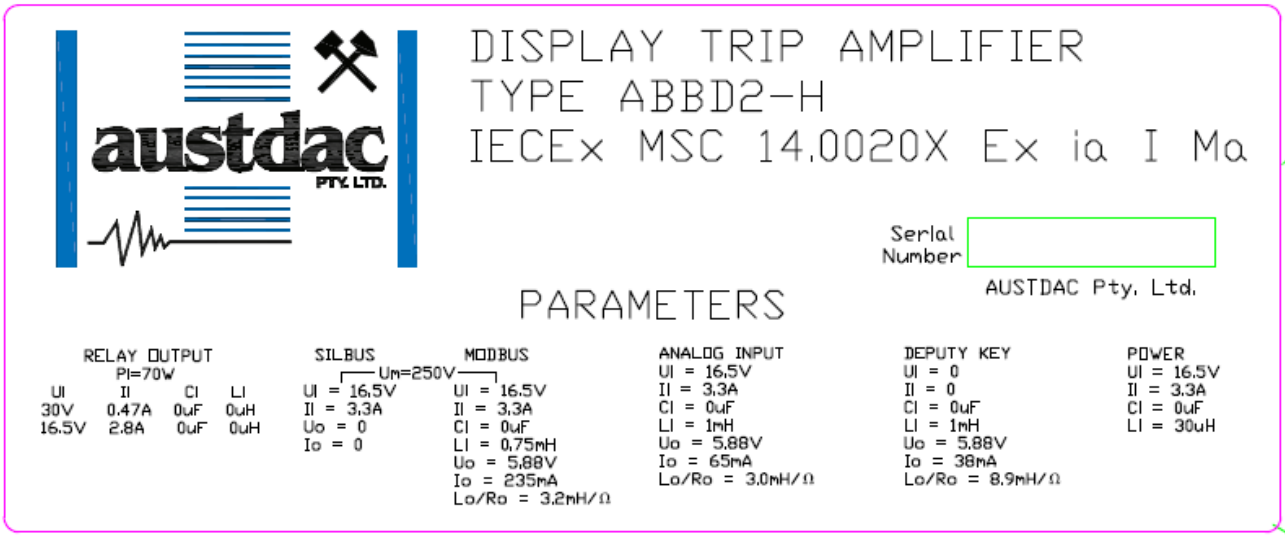


Figure 2 Certification Label for ABBD2-L or ABBD2-H.

Note: Ex certified ABBD2 may be used in non hazardous areas (safe areas) and be used in conjunction with non Ex protected equipment provided that all Ex markings are permanently removed.

4 THEORY OF OPERATION

The ABBD2 takes either a local 4-20mA input or remote 4-20mA signal via SILBUS, converts it to a gas level (or any other levels), and display it on the four LED character display. If local 4-20mA input (or inputs) are used the trip points and analogue 4-20mA value can be transmitted using SILBUS network. This will allow remote trip via a SCADA/PLC. Analogue values are transmitted using SILBUS network using either the ANALINK or FASTLINK protocols. The input channels are converted to a sixteen bit (Fastlink) or eight bit (Analink) value ready for transmission on SILBUS network.

See Austdac document 120-009-10 for a more detailed description of SILBUS communications.

If the Analink transmission protocol is selected then the input analogue is transmitted as a stream of 255 on / off bits preceded by a single bit that is asserted if a fault alarm has not been detected i.e. 4mA offset is present.

If the Fastlink transmission protocol is selected then the input analogue, including the 4mA offset is converted to a 16 bit binary value and transmitted along with a four bit checksum. In effect, the 4mA offset is transmitted to the receiver(s) where the decision in relation to a 4-20mA signal fault should be made. Faults are included in the ABBD2 to provide compatibility with the Analink protocol and to provide local warning of a signal fault.

Each analogue input is monitored for under range signal level by comparing it to an input independent under range fault level; if the input signal is below this configured level then a fault is generated. This fault can be transmitted as a digital signal on any valid configurable SILBUS channel address.

Each analogue input is also compared with up to three configurable rising or falling set points. If the analogue input signal passes a set point level, a digital alarm will be generated and relay activated. This alarm can be configured to transmit on any valid SILBUS channel address.

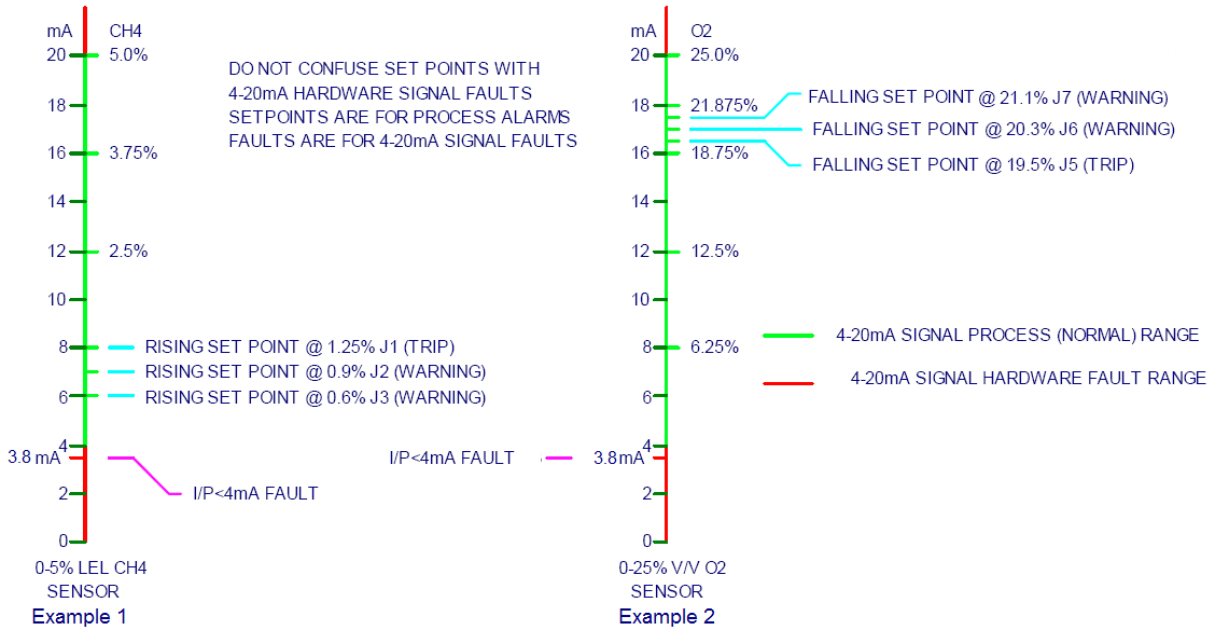


Figure 3 Set point and Fault operation

A common hysteresis level can be configured for all inputs to stop the fault signals or the set point alarm signals from chattering because of noise on the analogue input signals.

The above figure shows the difference between set points and signal faults, set points are reserved for process alarms while faults are reserved for 4-20mA signal issues like ‘less than 4mA’. Both set points and faults may be configured to generate a digital signal on any valid SILBUS channel address but only faults transmit 4-20mA embedded error signals in the Analink protocol.

All configurable aspects of the four channel analogue transmitter can be programmed via the console port. The transmitter will operate with 8, 16, 32, 64 and 128 channel SILBUS networks and will automatically configure to the number of channels of the connected SILBUS network.

The ABBD2 has a single MODBUS port that allows a PLC access trip points and analogue input levels. This access is currently read access only. The PLC can read the status of digital signals (standard digital) and the value of analogue signal (using Analink or Fastlink). Access to ABBD2 status and MODBUS communication diagnostic functions are also available. The ABBD2 is normally considered a slave device on the MODBUS network and therefore must be interrogated by a master device. Refer to the configuration section of this manual for instructions on setting network addresses etc..

For more information on MODBUS see document “MODBUS APPLICATION PROTOCOL SPECIFICATION 1.1a” and “MODBUS over Serial Line” or go to the industrial user group web site at http://www.modbus-ida.org

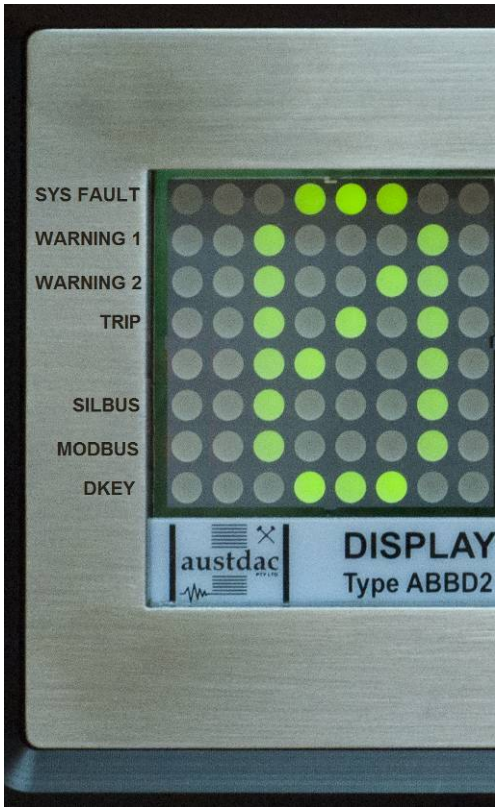
5 OPERATING INSTRUCTIONS

The ABDD2 can be separated into two parts. The front panel display, indicators and magnetic reed switch for displaying configuration information and the second part, the rear panel and it associated connections.

5.1 FRONT PANEL DISPLAY

The display is made up of four 8X8 LED matrix. The first column shows that status of ABDD2. When more information is needed to display the text scroll across the screen and status bit are temporary lost. The display adjusts the decimal point depending on the number displayed. For example for a 0-2.00% gas the decimal point is after the first digit. The fourth character can display either '%' or 'ppm' or blank. The same for 0-100 with one decimal point is required between 0.0-99.9 until 100 is reach and it then displays "100". Again, the units can be allocated. For large number such at 0-200ppm, no decimal point is displayed. Decimal point is automatically determined from the full scale calibration point.

5.2 FRONT PANEL COLUMN INDICATORS



The first left most LED column of the display is allocated to ABBD2 status. The front panel is label indicating the function, as shown in photograph here. Starting from the top:

- Red “SYSTEM FAULT” indicator, illuminates whenever there is a system fault.
- Yellow “WARNING 1” (Relay4) indicator, illuminates whenever the displayed value exceeds the warning 1 set point.
- Yellow “WARNING 2” (Relay3)indicator, illuminates whenever the displayed value exceeds the warning 2 set point.
- Red “TRIP” (Relay2 & Relay1)indicator, illuminates whenever the displayed value exceeds the trip set point.
- Blank, un-allocated LED.
- Green "SILBUS OK" indicator flashes every ten SILBUS scans (i.e. 13.6 seconds). Will illuminate yellow if there is a SILBUS addressing conflict. Red is no SILBUS is detected.
- Yellow "Modbus" indicator, illuminates whenever Modbus communication occurs.
- Yellow "Deputy Key" indicator, illuminates whenever the Deputy Key is pressed.

5.3 FRONT PANEL REED SWITCHES

On the front panel there are two reed switch marked "SELECT" and "ENTER". Using a magnet the operator can check parameters, test relays, test deputy key, RTC and view firmware version. Using "SELECT" key to select the function and "ENTER" key to enter the selected function and view or active functions. See table below:

Table 1: Front Panel Reed Switch Menu Guide

Function	Operation (Press "Enter" to see the following)
SBUS	Display SILBUS addressing, first three are the trip points (Warning 1, Warning 2 and Trip), Fastlink mark address, Analogue out SILBUS address and last in outbye SILBUS address. i.e. wrn1 then Enter A1
LEVL	Display the trip levels in display units

TEST	Test relays. Individual relays are tested. Warning 1, Warning 2 and then Trip.
DKEY	Test deputy key. Will indicate on or off.
RTC	Display time and date. HH:MM (09:06), DD:MM then YYYY
VER	Display version i.e. 1V00

5.4 REAR PANEL

The rear panel for the ABBD2 contains all the wiring connections and with the removed of six screws you can get access to the console port for one time configuration of the unit (as shown in the next section with a MEAN1). All the terminal blocks used on the ABDD2 are of the two part type that allow the wires to be terminated permanently and should the display need to be disconnected it is simply a matter of withdrawing the plug portion of the terminal block with the wires still terminated.

6 CONFIGURATION

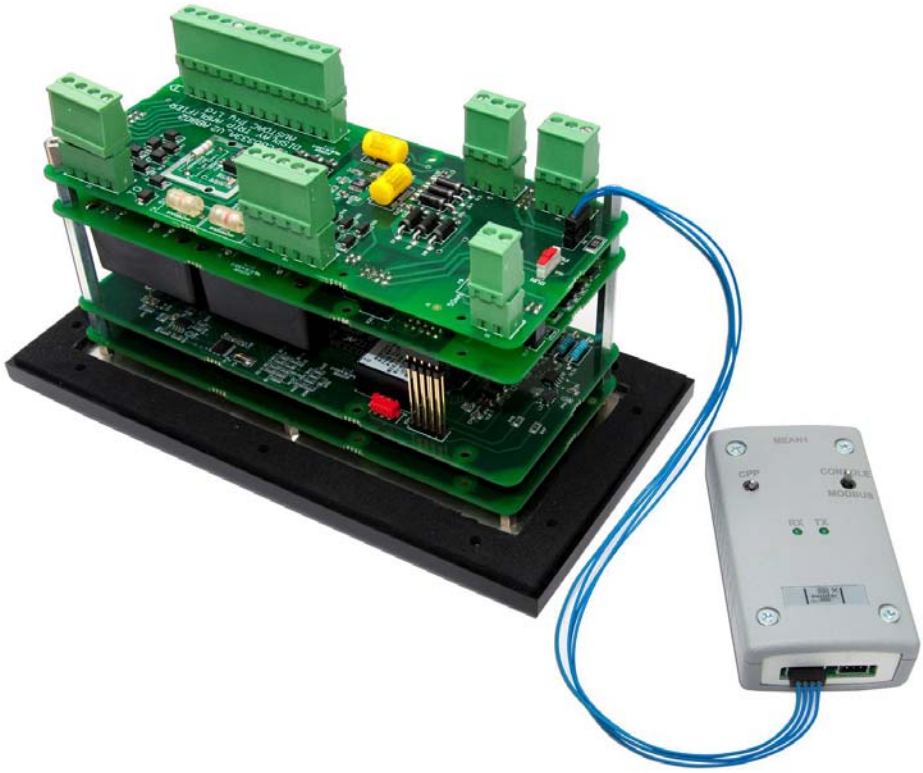
The ABBD2 has several operational parameters that require configuration prior to use. All of these parameters can be viewed and changed via the console port. The console port consists of a small four pin connector and a two position slide switch inside of the unit. Access to the console port can be gained by opening the back cover.

To use the console port an Austdac MEAN1 interface, A to B USB cable and laptop computer running Hyper Terminal are required.

For more detail on the console port, MEAN1 interface and their use refer to Austdac document 53018-11.

6.1 CONSOLE PORT OPERATION

The console port should be connected to a laptop running a terminal emulation program such as Hyper Terminal via the Austdac interface type MEAN1 and a USB cable as shown in the following photograph.



Photograph 2: Laptop connected to console port via MEAN1 interface

The ABBD2 certification places restrictions on what may be connected to the console port. The Austdac MEAN1 connection to the console port should only be used by the manufacturer.

The terminal emulation program should be configured to 19200 baud, 8 data bits, one stop bit, no parity, no flow control and DEC VT100 terminal emulation.

Once communications have been established with the ABBD2, it will display a screen of information that includes software version, software checksum, and a list of commands followed by the console port prompt.

The prompt includes an abbreviation of the transmitter type number. **ABBD2::>**

Commands are invoked by entering the command name followed by any optional modifiers, keywords and the “ENTER” key. The enter key is shown in the following examples as a “ ↵” symbol.

Note: Configuration the ABBD2 using the console port will affect the trip relays, MEAN1 CPP switch needs to be on (up) position while configuration is occurring. The unit can also be configured without 12V supplied (i.e. power from the MEAN1) if switch SW1 is switched to "PROG". In this mode, the display is turned off. The will need to return to RUN after the configuration.

6.2 HELP COMMAND

The HELP command prints a list of all available commands and shows the syntax for each command. Optional command modifiers are shown within [ ] while mandatory modifiers are shown within < >. An example of a screen output follows:

```
ABBD2::>help
Software 1V00 0xA4E1 Configuration 0xB385 SN:14101000
Commands:
 ------------------------------------------------------------------------------
            ********** Level 1: Standard Menu **********
  HELP     [1..7] Level of Help | [0 = all]      [] Optional, <> Required, | Or
  VER                                            Firmware version of Product
  REPEAT   [LF/CR] [Secs between lines]          Repeat Cmd, Linefeed/Carriage
  STACK                                          Display Peak Stack Usage
  RTC      [<SET> <YY:MM:DD hh:mm:ss>]           Real Time Clock
  LOG      [event]                               Display event log dump
  SBMAP                                          Display SILBUS I/O Map
  SBSTAT                                         Display SILBUS Status
  SBGET    <A1-P8>                               Display a SILBUS Chan Status
  MBSET    [<SET> [ADDRESS] [BAUD] [PARITY]]     Modbus Address, Baud & Parity
            ******* Level 2: SILBUS & TRIP MENUS *******
  INPUT    [<SET> <1|2|3|<A1-P8>]                Set Input Ch1,Ch2,Ch1+2 or SB
  SBADDR   [<SET> <A1-P8,DISABLE>]               Set SILBUS 4-20mA Out Address
  SBALRM   [<SET> <W1|W2|TRIP> <A1-P8,DIS>]      Set SILBUS Out Alarms
  FSTMRK   [<SET> <A1-P8,ANALINK>]               Set Fastlink Marker or Analink
  LATCH    [<SET> <ENABLE|DISABLE>]              Set Latch Trips, key required
  TYPE     [<SET> <RISE|FALL>]                   Set Trip on Rising or Falling
  LEVEL    [<SET> <W1|W2|TRIP> <level>]          Set Warning & Trip Levels
  HYST     [<SET> <%% of full range>]            Set Trip Point Hysteresis
            ****** Level 3: DISPLAY & UPLOAD MENU ******
  CALDSP   [<SET> <4mA Pt> <20mA Pt>]            Cal 4mA, 20mA Point Levels
  UNITS    [<SET> <%|PPM|BLANK>]                 Set Display Units
  WARMUP   [<SET> <seconds>]                     Set Initial Warm Up Period
  CFGUP                                          Upload Configuration Text
  CFGDWN                                         Download Configuration Text
 ------------------------------------------------------------------------------


ABBD2::>
```

6.3 REPEAT COMMAND

The REPEAT command is used after another command to continuously repeat that command. As an example the SBGET command can be executed followed by the REPEAT command to provide a continuously updating display of the selected SILBUS channel. The display will continue to update until any key is hit. The ABBD2 will respond by displaying the prompt.

```
ABBD2::>SBGET D1 ↵
D1 = ON

ABBD2::>REPEAT
D1 = OFF ↵

ABBD2::>_
```

In the above example the “OFF” changed to an “ON” whenever SILBUS channel D1 was activated. In this mode the repeat command writes over the previously displayed information, if required, the repeat command can be made to refresh the information on a new line by entering LF (line feed) as part of the command invocation. The repeat command refreshes the display every one second by default. The refresh rate can be slowed by entering the refresh rate in seconds as part of the repeat command as shown in the following command:

```
ABBD2::>REPEAT LF 5 ↵
D1 = OFF
D1 = OFF
D1 = ON
D1 = OFF
D1 = OFF
D1 = ON
D1 = OFF ↵

ABBD2::>_
```

As can be seen from the above example the repeat command refreshed the status of SILBUS channel D1 on a new line every five seconds. In the LF mode a record of the status of D1 can be viewed on the screen.

6.4 VERSION (VER) COMMAND

The VERSION command is used to display the serial number, abbreviated type number, software version, program memory checksum and configuration checksum of the ABBD2. The command can be invoked as shown in the following example:

```
ABBD2::>VER ↵
ABBD2 Software 1V01 0xBA57 Configuration 0xFFF6 SN:09124321

ABBD2::>_
```

This command is useful when the user needs to know the software version or serial number. The program memory checksum is useful to confirm that a software update has completed successfully without any programming errors.

6.5 STACK COMMAND

The STACK command is provided to allow the technician to gauge the health of the ABBD2 microprocessor and its code by displaying the maximum usage of the program stack. The display is a peak value of the stack usage since the ABBD2 was powered up. The command can be invoked as shown in the example below:

```
ABBD2::>STACK ↵
Stack usage/size = 454/1024
Percentage Used = 44%

ABBD2::>_
```

This command would typically only be used when requested by an Austdac software engineer.

6.6 LOG COMMAND

The LOG command is provided to allow the technician to monitor the logs of the UPS. The command can be invoked as shown in the example below:

```
ABBD2::>log
Stored events : 25
INDEX      TIME         EVENT  DATA1,  DATA2, DATA (DEC)
-----------------------------------------------------------
[001]  04NOV 10:57:36  0x14,  0x0000  0x0000       0       0
[002]  04NOV 10:57:36  0xFF,  0x0018  0x0004      24       4
[003]  04NOV 10:57:35  0x18,  0x37DB  0x0002   14299       2
[004]  04NOV 10:57:35  0x1A,  0x0331  0x0000     817       0
[005]  04NOV 10:57:35  0x18,  0x37DB  0x0002   14299       2
[006]  04NOV 10:57:33  0x16,  0x3955  0x0002   14677       2
[007]  04NOV 10:57:31  0x15,  0x3A56  0x0002   14934       2
[008]  04NOV 10:57:29  0x14,  0x0000  0x0000       0       0
[009]  04NOV 10:57:29  0xFF,  0x0018  0x0006      24       6
[010]  04NOV 10:57:27  0x18,  0x37BD  0x0002   14269       2
```

See document 00-037-37 Significant Event Register for interpretation of events. Repeatly typing log display then next 10 event until all the event are display. To return to top of logs you can type:

```
ABBD2::>log 0
```

Which will return you to the earliest logs.

6.7 REAL TIME CLOCK (RTC) COMMAND

The RTC command is provided to allow the technician to monitor the health of the ABBD2. The command displays any internal errors for analysis. The command can be invoked as shown in the example below:

```
ABBD2::>rtc

RTC Tue Nov  4 10:51:56 2014
```

6.8 SILBUS MAP (SBMAP) COMMAND

The SILBUS map command allows the operator to obtain a snapshot of the SILBUS network to which the transmitter is connected. The map shows all of the SILBUS channels available on the network. The map consists of a table with a heading of groups below which is displayed the channels using ones and zeros. Each group is shown vertically with 1 at the top and 8 at the bottom. A one indicates an ON channel and a zero indicates an OFF channel. An example of an SBMAP is shown below with channels A4, P7 and P8 on or active:

```
ABBD2::>SBMAP ↵
ABCDEFGHIJKLMNOP
0000000000000000
0000000000000000
0000000000000000
1000000000000000
0000000000000000
0000000000000000
0000000000000001
0000000000000001

ABBD2::>_
```

The SBMAP command is particularly useful when used with the repeat command as this will display a continuously updated table.

6.9 SILBUS STATUS (SBSTAT) COMMAND

The SILBUS status command displays the number of SILBUS channels available on the connected SILBUS network, a SILBUS synchronisation pulse count and a SILBUS error count. This command is used to determine if the connected SILBUS network is functioning correctly and how many channels are available. The error count should typically be zero while the sync count should be incrementing. Once again the use of the repeat command will provide a dynamic updating display. An example of the SBSTAT command follows:

```
ABBD2::>SBSTAT ↵
No. Chan = 128, Sync Count = 17807, Error Count = 0

ABBD2::>_
```

The error count will be non zero whenever the connected SILBUS network is out of specification. The error count can be non zero if the connected SILBUS network channel generator has its power supply cycled off and on. These error counts should be ignored.

6.10 SILBUS GET (SBGET) COMMAND

The SILBUS get command is used to display the status of one selected SILBUS channel only. If this command is used in conjunction with the repeat command a continuously updating display can be achieved. The command is invoked by entering the command name followed by the desired channel address as shown in the two examples below:

```
ABBD2::>SBGET M3 ↵
M3 = OFF

ABBD2::>SBGET B7 ↵
B7 = ON

ABBD2::>_
```

6.11 MODBUS SET (MBSET) COMMAND

This command is used to set the MODBUS Slave port parameters for the ABBD2. The slave address, baud rate and parity of the port can be configured. The number of stop bits is also configurable in party parameter (i.e. None1:, None2, odd and Even). The supported MODBUS protocol is *RTU 8-bit binary.*

The current MODBUS port configuration can be viewed by typing the MBSET command:

```
ABBD2::> MBSET ↵
MODBUS Setting Address = 6, Baud Rate = 9600, Parity = Even (1 Stop bit)
```

The slave address of the GSW1 can be changed to any address in the range 0 to 247. Address zero will disable the MODBUS port. The default slave address is 6. The following example shows the ABBD2 slave address being changed to 10:

```
ABBD2::>MBSET SET 10 ↵
Modbus Address changed to 10
```

The baud rate of the ABBD2 MODBUS port can be configured to 9600, 19200 or 38400. The default baud rate is 9600. The example below shows the baud rate being changed to 19200:

```
ABBD2::>MBSET set 19200 ↵
Modbus Baud changed to 19200
```

The ABBD2 MODBUS port parity can be configured to Even, Odd, None1 or None2. The default is Even. The example below shows the parity being changed to None one stop bit:

```
ABBD2::>MBSET set None1 ↵
MODBUS Parity changed to None1 (1 Stop bit)Setting Changed
```

6.12 INPUT ADDRESS COMMAND

This command is used to display and configure the input source for the ABBD2. The source are 4-20mA input 1, 4-20mA input 2, peak (assuming rising alarms) value between inputs 1 and 2 (tough in falling alarms) and lastly remote outbye SILBUS device transmitting using Analink or Fastlink protocols. The example below show setting input 1 channel:

```
ABBD2::>INPUT set 1 ↵
Setting Changed
Gas input on channel 1

ABBD2::>_
```

or setting a outbye SILBUS channel:

```
ABBD2::>INPUT set B1 ↵
Setting Changed
Gas input on outbye SILBUS address: B1

ABBD2::>_
```

The 4-20mA input or SILBUS level are converted to display value which trip level are determined from.

6.13 SILBUS ADDRESS (SBADDR) COMMAND

This command is used to display and configure the SILBUS 4-20mA address that will be used transmit the Analogue value either using Analink or a Fastlink protocol (see below). The example below show how to configure the unit:

```
ABBD2::>SBADDR set b8
Setting Changed
Data Out Address = B8
FASTLINK Address = --
Warning1 Address = --
Warning2 Address = --
Trip Address = --

ABBD2::>
```

6.14 SILBUS ALARMS (SBALRM) COMMAND

This command is used to display and configure the SILBUS trip alarm addresses. Each trip level is assigned a SILBUS address. The levels are Warning 1(relay4), Warning 2(relay3) and Trip(relay1 & relay2) and are associated with LEVEL command (see below). When level is reached, the assigned SILBUS channel turns off. That is the SILBUS I/O is transmitted fail safe method so if ABBD2 fails then I/O fails safe. The gas level (or other units) are safe when all channel are on that has assigned channel (i.e. not disable). The example below sets the trip value to B3:

```
ABBD2::>SBALRM set trip B3
Setting Changed
Data Out Address = B8
FASTLINK Address = --
Warning1 Address = B1
Warning2 Address = B2
Trip Address = B3

ABBD2::>
```

Above you can see B1 is assigned warning1, B2 is assigned warning2 and in this command, the Trip was assign SILBUS address B3.

6.15 FASTLINK MARKER/ANALINK (FSTMRK) COMMAND

This command is used to display and configure the FASTLINK marker SILBUS channel address for Fastlink or selects ANALINK protocol. A valid FASTLINK marker is required whenever there outbye SILBUS input is used or when transmitting a gas level using SBADDR command. The marker is generated by the GSW1 channel generator and can be any valid SILBUS channel address. Only one marker is required per SILBUS field bus

network. The current marker channel address can be displayed by simply entering the command name as shown in the example below:

```
ABBD2::>FSTMRK ↵
Fastlink Marker is A3

ABBD2::>_
```

The example below shows the format of the command when the marker address is configured. The keyword “SET” is required to invoke a change, followed by the SILBUS channel address of the FASTLINK marker. If FASTLINK is not to be used by the ABBD2 transmitter then the marker channel should be disabled. The keyword “DISABLE” or "ANALINK" is used when the marker channel is not required.

```
ABBD2::>FSTMRK SET ANALINK ↵
Setting Changed
Fastlink Marker is DISABLE, ANALINK SELECTED

ABBD2::>_
```

6.16 LATCHING ALARMS (LATCH) COMMAND

This command is used to display and configure the latching alarms command. When a trip occurs, relay1 & relay2 can be latched and only cleared with shorting the deputy key contacts. Otherwise if latching is disable, gas trip can be cleared and the relay energise when gas level return to normal. An example of turn latching on is shown here:

```
ABBD2::>LATCH set enable↵
Setting Changed
Latching is enable

ABBD2::>
```

and turning latching off:

```
ABBD2::>LATCH set disable↵
Setting Changed
Latching is disable

ABBD2::>
```

6.17 TYPE COMMAND

This command is used to display and configure the Type of alarms. Alarms can be rising or falling alarms. The TYPE command set type of alarm. Example below is a falling:

```
ABBD2::>TYPE set falling↵
Setting Changed
Alarm trips on falling levels

ABBD2::>
```

Again for rising alarms:

```
ABBD2::>TYPE set rising
Setting Changed
Alarm trips on rising levels

ABBD2::>
```

6.18 LEVEL COMMAND

This command is used to display and configure the trip levels in same unit that are display in the front panel display. That is if the scale is set for 0-5% (and display shows **0.00**) then level for warning 1, warning 2 and Trip will be in the range 0-5%. If the type of alarm is set to "Rise" then Warning 1 is less than Warning 2 is less than Trip levels. For example for a 5% gas level to set the following Warning 1: 1.00%, Warning 2: 1.125% and Trip set 1.25%:

```
ABBD2::>type
Alarm trips on rising levels

ABBD2::>LEVEL set w1 1.00
Warning: Value must be less than trip value (rising alarm)
Warning: Value must be less than warning2 value (rising alarm)
Setting Changed
Warning 1 Level 1.000
Warning 2 Level 0.000
Trip Level 0.000
```

then you would type:

```
ABBD2::>LEVEL set w2 1.125
Warning: Value must be less than trip value (rising alarm)
Setting Changed
Warning 1 Level 1.000
Warning 2 Level 1.125
Trip Level 0.000
```

then you would type:

```
ABBD2::>LEVEL set trip 1.25
Setting Changed
Warning 1 Level 1.000
Warning 2 Level 1.125
Trip Level 1.250


ABBD2::>
```

The warning message disappears once levels are correctly ordered. The level would reverse is order for falling alarms. That is in falling alarms the trip alarm would have the lowest level.

6.19 HYSTERESIS (HYST) COMMAND

This command is used to display and configure the hysteresis for the trip level as percentage of full scale. The hysteresis value is used to stop the set point alarms from switching on and off with any noise that may be present on the 4-20mA input signal. For example if the 4-20mA input was configured to 0-5% and currently at 3.99% and the set point level was set at 4% for a rising alarm, the input signal would only need slightly more than 0.01% of noise or jitter to cause the set point alarm to randomly switch on and off. By setting the hysteresis value to slightly higher than any known noise this random and annoying switching can be eliminated. The current hysteresis value can be displayed by simply entering the command name as shown in the example below:

```
ABBD2::>HYST ↵
Hysteresis level 5.0% of full-scale 5.0 = 0.3

ABBD2::>
```

If the command name is entered with additional attributes the hysteresis level can be configured to any valid level. An example of configuring the hysteresis level is shown below:

```
ABBD2::>HYST set 2 ↵
Setting Changed
Hysteresis level 2.0% of full-scale 5.0 = 0.1

ABBD2::>
```

6.20 CALIBRATE THE DISPLAY (CALDSP) COMMAND

This command is used to display and configure the calibration of 4 character LED display. The 4-20mA input either via input 1, 2 or via SILBUS outbye channel is converted using this command is display the gas as either percentage ("%") or parts per million (ppm). So for example, a 5% Methane (CH4) gas is represented at 4mA as 0.00% gas and at 20mA as full scale 5.00% gas. This example of the command is shown here:

```
ABBD2::>CALDSP set 0 5.00
Setting Changed
 4mA Point = 0.00
20mA Point = 5.00
CH1 Display level = 0.89
CH2 Display level = 0.81
!!!! WARNING !!!!
Gain and offset have changed
Check warning and trip levels

ABBD2::>
```

The warning is to remind you that the level trip point will need check as display representation has changed. The command also show the current input display values.

6.21 UNIT DISPLAYED (UNITS) COMMAND

This command is used to display and configure the display units. The fourth character position in most case is not used when the full scale value is less than one hundred (100). The unit can display "%", "PPM" or blank character. Thus as in the example above where units are calibrated for methane then fourth character in the display need to be set to "%". To do this you would type the following:

```
ABBD2::>UNIT set %
Setting Changed
Units changed to %

ABBD2::>
```

6.22 WARM UP PERIOD (WARMUP) COMMAND

This command is used to display and configure the warm up period in second. Warm up period is the time between power being applied and the gas value becomes valid. This command is used to help settle any input devices connected to the ABBD2 that has inaccuracy at start up. For example if you would like a 5 second warm up time you would type:

```
ABBD2::>WARMUP set 5
Warm up period is: 5s

ABBD2::>
```

6.23 UPLOAD CONFIGURATION COMMAND

The upload configuration command is used to extract the configuration profile of the ABBD2 via the MEAN1 interface and record it in a file on a PC. Having an exact copy of the configuration is useful for record keeping and future cloning of new ABBD2 transmitters for maintenance or system expansion. The upload is invoked by entering the command name without any attributes as shown in the example below.

```
ABBD2::>CFGUP ↵
CFGDWN
S00300000FC
S1130000000000001001022E00805600010500000CF
S113001080000000800000008000000080000000DC
S11300208000140008001E00090028000A000000D7
S1130030800000008000000064920000011002ED9AE
S9030000FC

ABBD2::>_
```

The configuration is uploaded and displayed on the screen in Motorola S1-S9® HEX format. This data format includes headers and checksums to guard against errors and corruption of the data. The first line of the uploaded configuration is the keyword “CFGDWN” this does not form part of the data but is included to help with the configuration download process, see section 5.17 below for details.

To save the configuration to a file, open Notepad or a similar non-word processing editor, highlight the uploaded configuration as indicated below and copy to Notepad via the clipboard. The Notepad file should then be saved with a meaningful title that reflects the application e.g. ABBD2_xxx.CFG. When highlighting the uploaded configuration, ensure that the invisible carriage returns (CR) at the end of all lines are included. Also ensure that the CFGDWN keyword is included.

```
ABBD2::>CFGUP ↵
CFGDWN
S00300000FC
S113000000000001001022E00805600010500000CF
S113001080000000800000008000000080000000DC
S113002080001400080001E00090028000A000000D7
S113003080000000800000006492000011002ED9AE
S9030000FC

ABBD2::>_
```

The copy and paste method is used in this manual because it is the most universal method that works with all terminal emulation programs such as HyperTerminal®. Do not use an editor that introduces hidden formatting characters as a future download may not work with these characters in place. Many terminal emulation programs have automatic means to upload the configuration directly into a file; these are not described here as they differ from program to program but there is no restriction on using these features. Austdac is planning to release a complete tool to allow direct upload, download and editing of the configuration profile.

6.24 DOWNLOAD CONFIGURATION COMMAND

The download configuration command is used to take a previously saved configuration from a file and download it to the target ABBD2. This method of configuration ensures exact cloning during maintenance and system expansions.

Communications with the target must first be established via the MEAN1 interface and a terminal emulation program such as Hyper Terminal®. The cursor should be left at the ABBD2 prompt as follows.

```
ABBD2::>_
```

Open the previously saved configuration file in Notepad or a similar non-word processing editor and highlight the configuration as shown below.

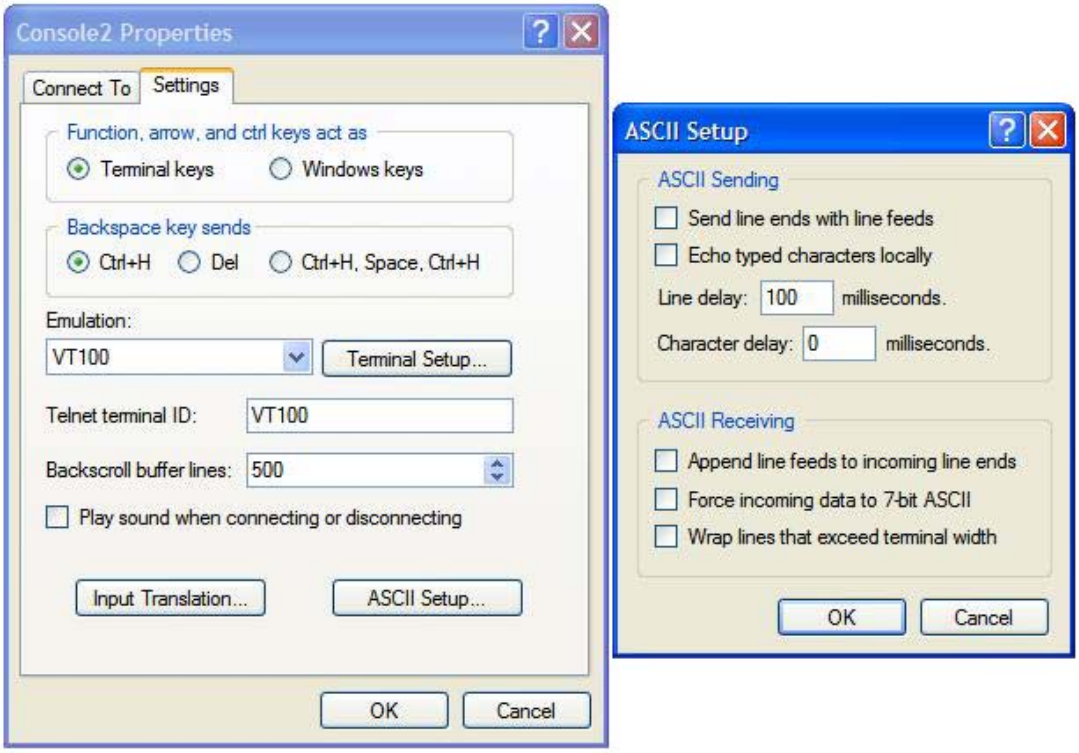
```
CFGDWN
S00300000FC
S113000000000001001022E00805600010500000CF
S113001080000000800000008000000080000000DC
S113002080001400080001E00090028000A000000D7
S113003080000000800000006492000011002ED9AE
S9030000FC
```

Copy and paste the configuration from Notepad to the ABBD2::> prompt in Hyper Terminal as shown below. Note CTRL-V does not work in Hyper Terminal.

```
ABBD2::>CFGDWN
S00300000FC
S1130000000001001022E00805600010500000CF
S113001080000000800000008000000080000000DC
S11300208000140008001E00090028000A000000D7
S11300308000000080000000649200001100 2ED9AE
S9030000FC↵

ABBD2::>_
```

The first line of the configuration contains the keyword “CFGDWN” which instructs the target to accept the data records. This “CFGDWN” keyword should have been copied from a previous upload and saved in the configuration file. Automatic file transmission features of the terminal emulation program may be used to download configuration files.



Photograph 3 Hyper Terminal delay setup

The terminal emulation program should be set up to allow a 100mS wait period after the carriage return at the end of each line during a download, this gives the target time to process the incoming data.

7 Display Trip Amplifier Safety Functions

The following instructions are applicable when the ABBD2 Display Trip Amplifier is used as an element in a safety function that is specified to achieve a Safety Integrity Level (SIL), e.g. SIL 1, 2, etc.

The reliability of the ABBD2 Display Trip Amplifier has been assessed in accordance with AS/IEC 61508 for use in SIL applications. The compliance with AS/IEC 61508 includes hardware reliability (probabilistic type failures) and measures to address systematic type failures.

The information that follows forms the 'Safety Manual' required by AS/IEC 61508-2 and is intended to allow correct product selection, system integration, installation, operation and maintenance to enable the SIL specified for the safety function to be achieved and maintained, as far as the ABBD2 Display Trip Amplifier is concerned.

The actual SIL will depend on many system considerations that are outside the scope of the ABBD2 Display Trip Amplifier and will rely on personnel who are competent in the functional safety aspects of the various lifecycle activities mentioned above.

7.1 SIL SUITABILITY

The ABBD2 Display Trip Amplifier is suitable for use in local and remote gas detection and trip safety functions that have a specified Safety Integrity Level (SIL) in accordance with AS/IEC 61508 up to and including:

SIL 2 - when used in a 'Low Demand' or ‘High Demand’ safety function.

The functional safety data in the following tables must be taken into account by integrators and end-users, including compliance with the restrictions in use and all other provisions and conditions in this manual

System integrators and end users responsible for other lifecycle phases (system specification, integration, installation, commissioning, operation, maintenance, etc.) need to perform assessments on the complete scope of their activities to ensure a target SIL for the safety function is and continues to be met.

7.2 SUMMARY OF THE FUNCTIONAL SAFETY DATA

The ABBD2 is capable of providing several independent safety functions. These functions are summarised in the following table:

SF Identifier	SF Description	Parameter	Value
SF#1	Local gas level detection with local relay trip.	SIL Allocation - Low Demand	SIL 2
		SIL Allocation - High Demand	SIL 2
		Diagnostic Test Interval	< 1h
		Proof Test Interval	1 year
		Mean Time To Repair (MTTR)	1 hour
		Probability of Failure on Demand (PFDAVG)	$7.46x10^{-5}$
		Probability of dangerous Failure per Hour (PFH)	$1.70x10^{-8}$ 1/h
SF#2	Local gas level detection with remote SILBUS trip.	SIL Allocation - Low Demand	SIL 2
		SIL Allocation - High Demand	SIL 2
		Diagnostic Test Interval	< 1h
		Proof Test Interval	1 year
		Mean Time To Repair (MTTR)	1 hour
		Probability of Failure on Demand (PFDAVG)	6.02x10-5
		Probability of dangerous Failure per Hour (PFH)	1.37x10-8 1/h
SF#3	Remote gas level detection over SILBUS with local relay trip.	SIL Allocation - Low Demand	SIL 2
		SIL Allocation - High Demand	SIL 2
		Diagnostic Test Interval	< 1h
		Proof Test Interval	1 year
		Mean Time To Repair (MTTR)	1 hour
		Probability of Failure on Demand (PFDAVG)	7.46x10-5
		Probability of dangerous Failure per Hour (PFH)	1.70x10-8 1/h

7.3 DEFINITIONS

7.3.1 "Safe State"

A “safe state” of the Display Trip Amplifier is deemed to be present when it is in a “trip” state (preventing EUC operation and/or sounding dangerous gas level alarms), i.e. when the following are achieved:

- Trip output NO contacts are open circuit and NC contacts are closed.
- SILBUS safety channels indicate trip state.

7.3.2 Process Time

The process time of the Display Trip Amplifier is less than 20 seconds

- Time from gas level reaching trip point at local gas sensor to setting relay.
- When used with Trolex TX6383, see data sheet for Trolex TX6373 for response times for other gases.

7.3.3 Transmission Delay

Transmission delay is 10 seconds

- Time from detecting trip gas level from local gas sensor to remote device receiving SILBUS data.
- Time from remote device sending SILBUS data to setting the local relays.

7.3.4 Fault Reaction Time

The fault reaction time of the Display Trip Amplifier is T_{FLT_MAX} = 10 seconds

- Detected internal faults lead to a safe state.

7.3.5 Demand Mode

The Display Trip Amplifier works in high demand applications.

7.3.6 Conditions or Restrictions for use in SIL Applications

The sections of this installation and operations manual shall be strictly complied with to ensure validity of the failure data and systematic safety integrity. The following additional restrictions and conditions apply when the unit is used in SIL applications:

1. The host controller must monitor the ABBD2 Gas Trip Amplifier status (via SILBUS or Modbus) at an appropriate frequency for the application (safety time) and initiate a safe action (e.g. process shutdown, evacuation, etc.) or be repaired within the MTTR assumed in the PFD calculations shown in the table above if an out-of-range (Low) output signal or fault condition is indicated.

2. If the MTTR or the proof test interval (TI) is different from those assumed in this manual then the PFD_{AVG} should be re-calculated and the SIL capability re-verified accordingly.

3. The display is for indication only and is not part of the safety function.

4. The environmental limits are restricted to: 0 to 50^{O}C and relative humidity 10% to 90%

5. AS/IEC 61508 limits use to SIL 1 in high or continuous mode of operation when used in a non-redundant configuration.

6. The unit must be proof tested at commissioning and at 12 month intervals during operation.

7.3.7 Proof Testing

Periodic proof tests of the safety function must be performed to identify any undetected dangerous failures. Faults identified by this test must be repaired within the MTTR and the unit returned to full working order.

A suitable proof test interval should be used in order to achieve the required average probability of failure on demand (PFD_{AVG}). A nominal interval of 8,760 hours (1 year) and Mean Time To Repair (MTTR) of 1 hour has been used in the derivation of PFD_{AVG}.

Ideally, the proof test interval shall be no shorter than the maximum gas sensor calibration time (or proof time) which is 1 week for Class-II equipment in AS2290.3-1990.

Proof Testing requirements are given later in the section **7.3** of this document.

7.4 SAFETY FUNCTIONS

7.4.1 SF#1: Local gas level detection with local relay trip

7.4.1.1 Demand Rate

Continuous

7.4.1.2 When Safety Function is demanded

Detect gas level via local analogue input. While gas level is below configured value the local relays are energised so NO contacts are closed and NC contacts are open. When gas level exceeds configured value local relay is de-energised so NO contacts are open and NC contacts are closed.

7.4.1.3 When a fault occurs

Local relays are de-energised so NO contacts are open and NC contacts are closed.

Additionally, fault status will be indicated on the display on the allocated SILBUS channel and in the corresponding MODBUS registers.

7.4.1.4 Operating Modes

This SF shall be active post power-up after a configured system warm up time (gas sensor warm up time) has elapsed and enters the gas level monitoring mode. The system shall continue to monitor gas levels post trip condition. The relays will latch post trip condition until reset by a deputy key.

This SF is inactive during the system (gas sensor) warm up period. This SF is disabled when SF#3 is active.

The priority of this SF when simultaneously active with other SF's is equal with SF#2.

7.4.1.5 Response Time

The response delay of the SF from sensing an input (or change in input) to actuation (whether under a demand or under a fault) shall be less than 20 seconds. This is the time from the gas level reaching trip point at local gas sensor to setting the relay.

7.4.1.6 Safety Integrity Requirements – AS61508

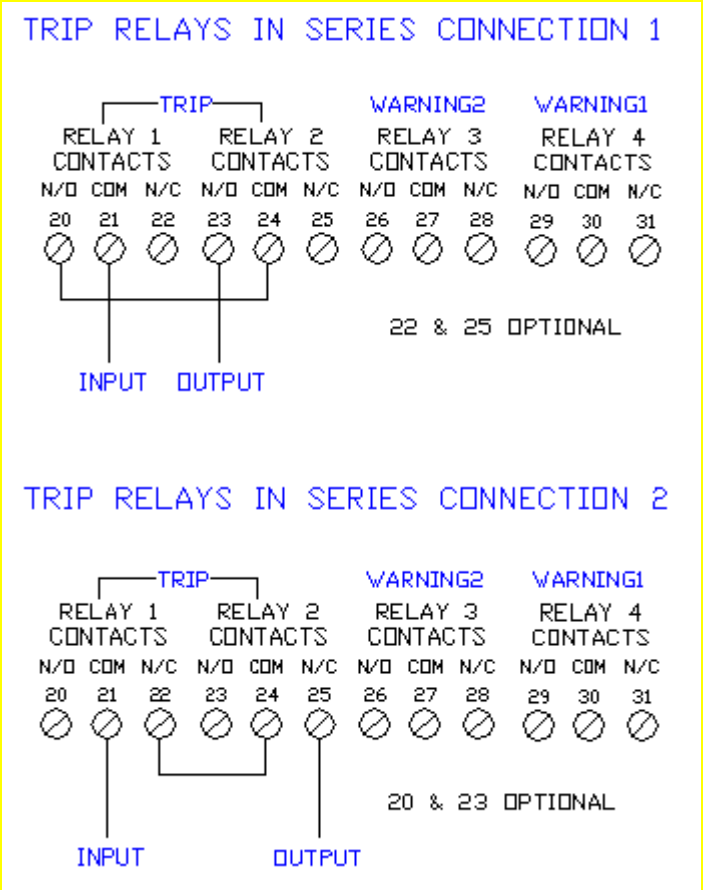
This SF meets the requirements of AS61508 for SIL 2 in continuous demand mode.

The PFH of this SF does not exceed 15% of the complete safety chain which is 1.5×10^{-7} 1/h.

All hardware utilised by this SF meets the Hardware Fault Tolerance (HWFT) and Safe Failure Fraction (SFF) architectural requirements commensurate with SIL 2 according to AS61508.2 Tables 2 and 3.

7.4.1.7 Installation and Configuration

Both trip relays must be wired in series to meet the requirements of section **7.4.1.6**.



Both gas input channels must be used with gas sensors located in close proximity to each other.

The configuration information are in section **6.16 ~ 6.19**.

7.4.2 SF#2: Local gas level detection with remote SILBUS trip

7.4.2.1 Demand Rate

Continuous

7.4.2.2 When Safety Function is demanded

Detect gas level via local analogue inputs and the value is transmitted via SILBUS to a receiver. If a trip value is configured SILBUS safety channels may be used to indicate safe and trip states.

7.4.2.3 When a fault occurs

The gas value channel(s) on SILBUS will indicate a trip or fault condition. The trip indicator SILBUS safety channels shall indicate a trip state. If there is a SILBUS fault the local relay shall be de-energised.

Additionally, fault status will be indicated on the display and on SILBUS channel and MODBUS registers.

7.4.2.4 Operating Modes

This SF will be active post power-up after a configured system warm up time (gas sensor warm up time) has elapsed and enters the gas level monitoring mode. The system shall continue to monitor gas levels post trip condition.

This SF is inactive during the system (gas sensor) warm up period. This SF is disabled when SF#3 is active.

The priority of this SF when simultaneously active with other SF's is equal with SF#1.

7.4.2.5 Response Time

The response delay of the SF from sensing an input (or change in input) to actuation (whether under a demand or under a fault) shall be less than 20 seconds. This is the time from the gas level reaching trip point at local gas sensor to setting the SILBUS data.

The transmission delay is 10 seconds which is the maximum time for transmitting the gas level or trip condition to the remote device receiving SILBUS data.

7.4.2.6 Safety Integrity Requirements – AS61508

This SF meets the requirements of AS61508 for SIL 2 in continuous demand mode.

The PFH of this SF does not exceed 15% of the complete safety chain which is $1.5x10^{-7}$ 1/h.

All hardware utilised by this SF meets the Hardware Fault Tolerance (HWFT) and Safe Failure Fraction (SFF) architectural requirements commensurate with SIL 2 according to AS61508.2 Tables 2 and 3.

7.4.2.7 Installation and Configuration

Both gas input channels must be used with gas sensors located in close proximity to each other.

The configuration information are in section **6.8 ~ 6.10, 6.12 ~ 6.15**.

7.4.3 SF#3: Remote gas level detection over SILBUS with local relay trip

7.4.3.1 Demand Rate

Continuous

7.4.3.2 When Safety Function is demanded

Gas level is detected remotely and transmitted over SILBUS. The transmitted gas level is received by the Display Trip Amplifier over SILBUS. While gas level is below the configured value the local relay is energised so NO contacts are closed and NC contacts are open. When gas level exceeds the configured value local relay is de-energised so NO contacts are open and NC contacts are closed. Alternatively a SILBUS safety channel may be used to trip the relay.

7.4.3.3 When a fault occurs

Local relay is de-energised so NO contacts are open and NC contacts are closed.

Additionally, fault status will be indicated on the display and on SILBUS channel and MODBUS registers.

7.4.3.4 Operating Modes

This SF shall be active whilst receiving valid SILBUS data.

This SF may be disabled / inactive during system when there is no valid SILBUS data.

This SF is disabled when the other SF SF#1 or SF#2 are active.

7.4.3.5 Response Time

The response delay of the SF from sensing an input (or change in input) to actuation (whether under demand or under a fault) shall be 10 seconds. This is the transmission delay from the remote device setting the SILBUS data to de-energising the local relay.

7.4.3.6 Safety Integrity Requirements – AS61508 / AS62061

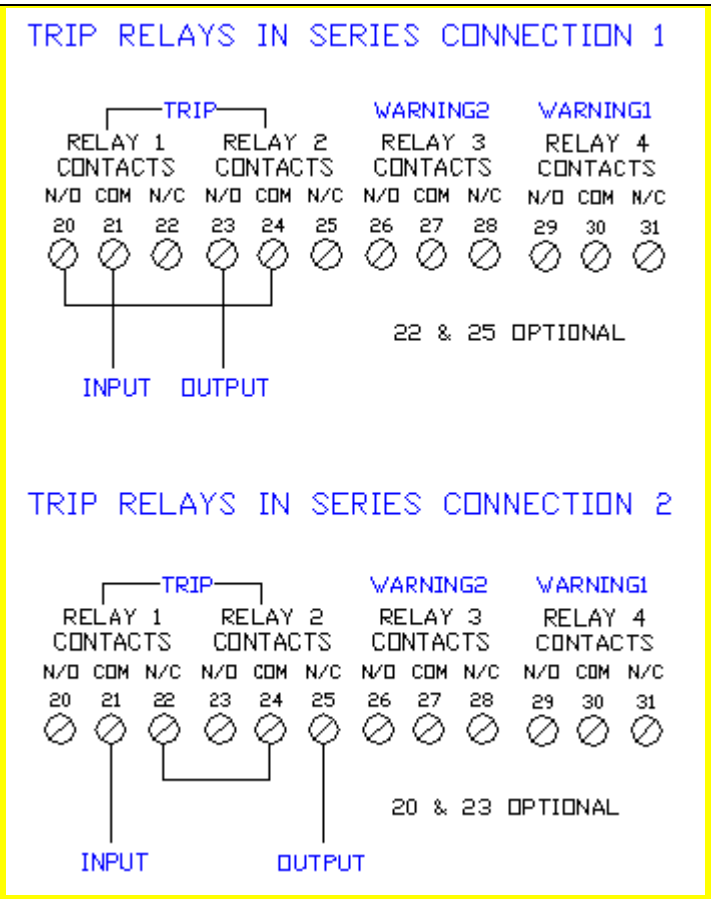
This SF meets the requirements of AS61508 for SIL 2 in continuous demand mode.

The PFH of this SF does not exceed 15% of the complete safety chain which is $1.5x10^{-7}$ 1/h.

All hardware utilised by this SF meets the Hardware Fault Tolerance (HWFT) and Safe Failure Fraction (SFF) architectural requirements commensurate with SIL 2 according to AS61508.2 Tables 2 and 3.

7.4.3.7 Installation and Configuration

Both trip relays must be wired in series to meet the requirements of section **7.4.1.6**.



The configuration information are in section **6.16 ~ 6.19**.

7.5 PROOF TESTING AND MAINTENANCE

7.5.1 Proof Test Interval

The proof test interval shall be no shorter than the maximum gas sensor calibration time (or proof time) which is 1 week for Class-II equipment in AS2290.3-1990.

7.5.2 Proof Test Procedure

Procedure for testing undetectable dangerous failures - i.e. the relay test procedure.

- May use the menu system to forcibly open the relays and force a trip.
- Alternatively, while testing the gas sensors, gas levels greater that trip value will trip the relays, effectively testing them.
- Need to check both relays open, not just one.

7.5.3 Maintenance Log

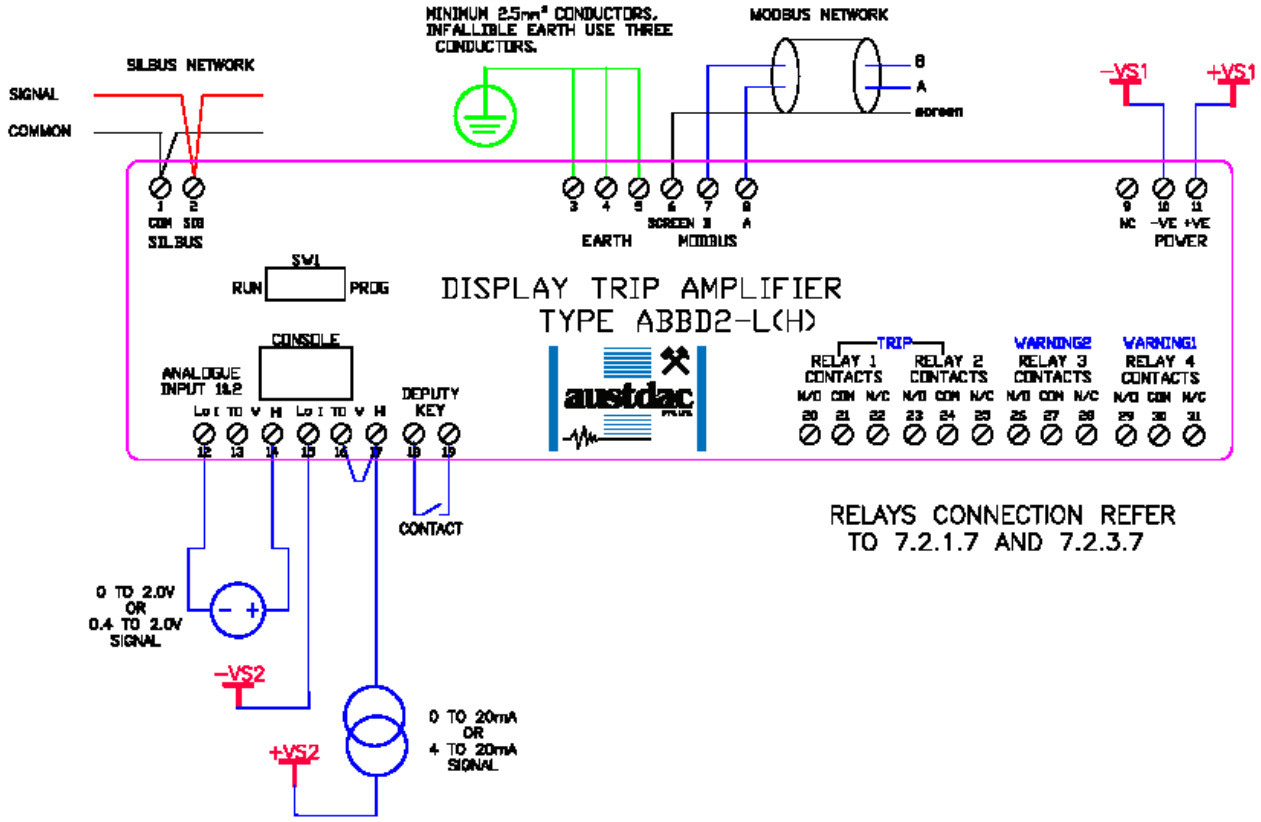
A log for recording the maintenance history of the system in **12** of this document.

7.5.4 Fault Conditions

In the event of a fault return the unit to Austdac for fault diagnosis and repair.

8 TERMINATIONS AND CONNECTIONS

All the terminal blocks used on the ABBD2 are of the two part type that allow the wires to be terminated permanently and should the display need to be disconnected it is simply a matter of withdrawing the plug portion of the terminal block with the wires still terminated, these terminals can accommodate up to 4mm^2 conductors. There are seven possible connections to the ABBD2; these are shown in the following tables and diagrams:



ABBD2 ONLY ALLOWS TO CONNECT A SINGLE PHASE Um=250V

8.1 FOUR OUTPUT RELAY PORT

Twelve terminals 20~31 are provided for connection to the trip or warning relays voltage free contacts. The voltage free contacts are in the form of one set of voltage free change over contacts (form C). The connection designations are shown in the following table.

TRIP OR WARNING RELAY CONNECTIONS		
TERMINAL	DESIGNATION	DESCRIPTION

NUMBER		
22,25,28,31	N/C	NORMALLY CLOSED CONTACT
21,24,27,30	COM	COMMON CONTACT
20,23,26,29	N/O	NORMALLY OPEN CONTACT

8.2 SILBUS NETWORK PORT

The SILBUS network port provides a means for the ABBD2 to be connected to a SILBUS network. Any connections to a SILBUS field bus network pair should be of a multi-drop nature with spur lengths kept to a minimum. This will minimize any reflections and therefore communications errors in the SILBUS network. The connection designations are shown in the following table

SILBUS NETWORK PORT TERMINATIONS		
TERMINAL	DESIGNATION	DESCRIPTION
2	SIG	SILBUS NETWORK SIGNAL
1	COM	SILBUS NETWORK COMMON

8.3 MODBUS NETWORK PORT

The ABBD2 MODBUS RS485 port can be freely connected to any compatible network without consideration of the Ex properties of the unit provided that network has an Um ≤ 250V. The connection designations are shown in the following table

MODBUS RS485 TERMINATIONS		
TERMINAL NUMBER	DESIGNATION	DESCRIPTION
8	DATA A+	RS485 A+ LINE (NOT INVERTED)
7	DATA B-	RS485 B- LINE (INVERTED)
6	SCREEN	SCREEN REFERENCE (GROUND)
3,4,5	EARTH	EARTH

Any connections to the MODBUS RS485 network should be of a multi-drop nature with spur lengths kept to a minimum. This will minimize any reflections on the signal pair.

8.4 TWO ANALOGUE INPUT PORT

Six terminals 12~17 are provided for the connection of the analogue input signal. The analogue input is a differential type that is capable of reading only the wanted signal from sources with a significant common mode voltage. The LO (low) input terminal should be connected to the most negative or ground point of the input signal. The HI (high) input terminal should be connected to the most positive point of the voltage input signal. The HI (high) to LO (low) input terminal should be connected to HI (high) input terminal as the current input signal. The analogue input can accept the input signal in two formats, 4-20mA and 0.4-2.0V. The connection designations are shown in the following table:

TWO ANALOGUE INPUT CONNECTIONS

TERMINAL NUMBER	DESIGNATION	DESCRIPTION
12,15	LO	LOW OR COMMON INPUT SIGNAL
14,17	HI	HIGH OR POSITIVE INPUT SIGNAL
13,16	I TO V	CURRENT TO VOLTAGE CONV RESISTOR INPUT

8.5 DEPUTY KEY RESET LATCHED TRIPS

Two terminals 18 and 19 are provided for the connection of the deputy key reset switch. The deputy key when configured in latch mode will reset the tripped relays only if the gas levels are below the trip level (rising alarms). The deputy key must be a voltage free contact. The connection designations are shown in the following table.

DEPUTY KEY RESET CONNECTIONS		
TERMINAL NUMBER	DESIGNATION	DESCRIPTION
18	LO	DEPUTY KEY RESET SWITCH
19	HI	DEPUTY KEY RESET SWITCH

8.6 POWER SUPPLY INPUT PORT

Two terminals 16 and 17 are provided for the connection of the incoming power supply. The connection designations are shown in the following table.

POWER SUPPLY INPUT CONNECTIONS		
TERMINAL NUMBER	DESIGNATION	DESCRIPTION
10	-VE	POWER SUPPLY COMMON
11	+VE	POWER SUPPLY POSITIVE

9 CERTIFICATION

The ABBD2 has been awarded IECEx certification under IECEx MSC 14.0020X, Ex ia Ma I.

The certification requires that the ABBD2 be mounted within a host enclosure(for example DWG: **13-363-14**) that provides a minimum ingress protection of IP66.

The certificate should be consulted for any special conditions of use when designing the ABBD2 into an installation.

10 SOFTWARE REVISION AND DISPLAY

The software version of the ABBD2 will vary as its functionality is improved at the request of our customers. The software version is given in two parts, the major revision level and the minor revision level and is written in the following format:

`VERSION M.mm` where M represents the major revision level and mm represents the minor revision level. E.g. VER 1.12

The software version can be determined by using the VER command on both console ports. Both ports should give the same firmware version. Refer to the ABBD2 software release register (13-367-01) for a history of software / firmware updates.

11 SPECIFICATION

Name	Display Trip Amplifier
Type	ABBD2
I. S. protection	Ex ia I Ma
Safety integrity level	SIL 2
Application location	Safe area or Hazardous area
30mm 8x8 dot matrix display	4
SILBUS 2 wire interface	1
SILBUS channel	8, 16, 32, 64 or 128
MODBUS 3 wire RS485 port	1
MODBUS database type	Trips, Warnings and 4-20mA level
Number of analogue channels	2
Analogue input current signal range	4-20mA
Analogue input voltage signal range	0.4-2.0V
Analogue input current to voltage conversion resistance	100Ω 0.1%
Analogue transmission protocol	FASTLINK or ANALINK
Console port configuration	19200 baud, 8 data, 1 stop, No parity
Number of relay outputs	4
Relay output maximum switching voltage (ABBD2-L)	30VDC
Relay output maximum switching current (ABBD2-L)	1A
Relay output maximum switching power (ABBD2-L)	25W
Relay output maximum switching resistance (ABBD2-L)	0.1 Ω

Relay output maximum switching voltage (ABBD2-H) 30V

Relay output maximum contact current (ABBD2-H) 2.8A

Relay output maximum contact power (ABBD2-H) 70W

Relay output maximum contact resistance (ABBD2-H) 0.5Ω

Relay output contact material ..... Rhodium

Ingress protection (when mounted in a suitable enclosure) IP66

Operating temperature range ..... 0ºC to 50ºC

Storage temperature range ..... -20ºC to 80ºC

Operating relative humidity range ..... 10% to 90% Non condensing

Operating voltage range ..... 8~16.5VDC

Maximum current consumption 110mA

Size ..... 214mm (W) x 113mm (H) x 120mm (D)

Mass 1.4kg

12 ABBD2 MAINTENANCE LOG

ABBD2 MAINTENANCE LOG				
Proof Test Interval Below	Date (DD/MM/YYYY)	Frequency	Results	Required For SIL Proof Test
Warning2(Relay3): NO		1 week		x
Warning2(Relay3): NC		1 week		x
Warning1(Relay4): NO		1 week		x
Warning1(Relay4): NC		1 week		x
Trip(Relay1):NO		1 week		✓
Trip(Relay1):NC		1 week		✓
Trip(Relay2):NO		1 week		✓
Trip(Relay2):NC		1 week		✓
Gas Sensor 1 Trip Value Test		1 week		x
Gas Sensor 2 Trip Value Test		1week		x
u Controller Restart Test (ABBD2 Restart)		1 week		✓
Local Gas Level with SILBUS Trip Test		1 week		x