



Title

4 CHANNEL ANALOGUE TRANSMITTER TYPE SILBUS-TX4A(G) USER'S MANUAL

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REVISION CONTROL

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1 GENERAL DESCRIPTION

The four channel analogue transmitter is part of a family of explosion protected DIN rail mounting modules that transmit to and receive from an Austdac SILBUS field bus network. The SILBUS-TX4A(G) can transmit up to four 4-20mA or 0.4-2.0V analogue signals on four independent valid SILBUS channels. The SILBUS-TX4AG variant has been re-scaled to accept 0.44-2.2V input signals only. See section 8 for more details on the SILBUS-TX4AG.

The four analogue inputs are galvanically isolated from the SILBUS network port. This isolation allows the SILBUS-TX4A to provide many simple and highly effective solutions when used in installations involving intrinsically safe and non-intrinsically safe circuits.

The transmitter is housed within a DIN rail mounting enclosure measuring 100mm (W) x 75mm (H) x 110mm (D). The front panel is located between the two top of enclosure mounted terminal blocks to provide a clear view of the operation indicating LED's. Two LED's are provided to show power and SILBUS network status.

The SILBUS-TX4A can be quickly and simply configured using a laptop computer running Hyper Terminal and a small plug in programming adaptor. Each analogue input can be independently programmed to any SILBUS channel address. Each analogue input can also have it's under range, hysteresis, digital fault channels and transmission protocol configured by the user.

2 WARNINGS AND PRECAUTIONS

WARNING

- If the SILBUS-TX4A(G) is used in a manner not specified by Austdac then the protection provided by the SILBUS-TX4A(G) may be impaired.

PRECAUTIONS

- Only qualified personnel shall install and service the SILBUS-TX4A(G).
- Mains supply fluctuations are not to exceed $\pm 10\%$ of the nominal supply voltage.

SYMBOLS



AC SUPPLY



DC SUPPLY



EARTH

2.1 USER ACCESS

There are no user serviceable parts within the SILBUS-TX4A(G). The user should not open or disassemble the SILBUS-TX4A(G).

2.2 STORAGE, INSTALLATION, USE AND MAINTAINANCE REQUIREMENTS

The SILBUS-TX4A(G) should only be installed, operated and maintained by qualified personnel in accordance with the condition of safe use as outlined in the certificate.

Ensure that all instructions and warnings are observed.

2.2.1 Storage

The specified storage temperature must be maintained during storage.

2.2.2 Installation and conditions of use

Prior to installation the SILBUS-TX4A(G) should be inspected for the following;

- Any external damage to the enclosure.

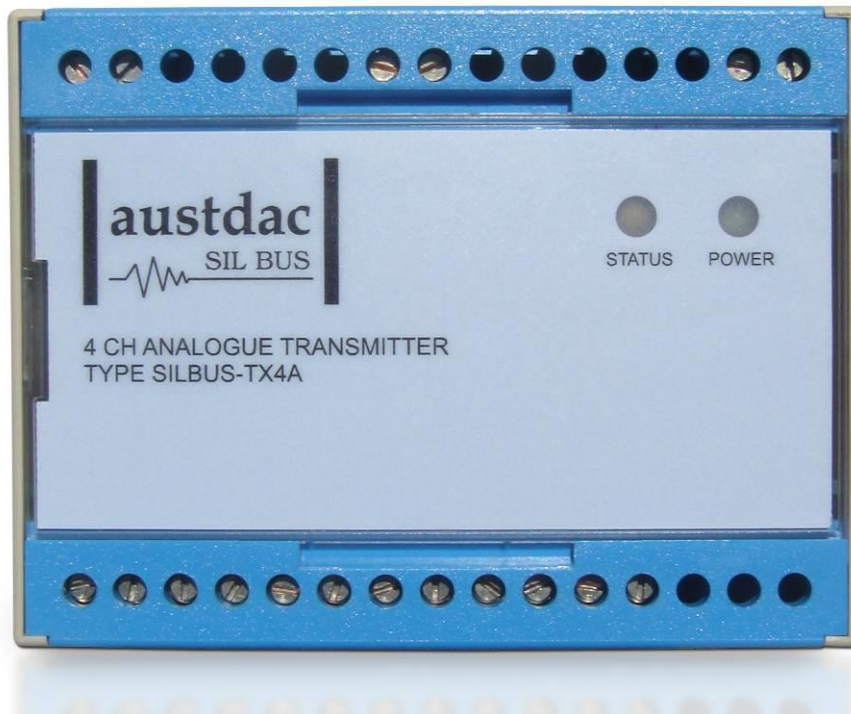
The SILBUS-TX4A(G) may be installed in any orientation.

The SILBUS-TX4A(G) must be installed in a suitably certified IP54 or better enclosure or as required by legislation. The enclosure should provide adequate protection, from impact and ingress of dust and water.

The SILBUS-TX4A(G) should be mounted to a stable surface avoiding areas under constant vibration and shock.

3 FRONT PANEL LAYOUT

The four channel analogue transmitter front panel is located between the terminal blocks that form part of the enclosure. The front panel is shown in photograph 1 below.



Photograph 1 SILBUS-TX4A front panel

Located in the top right hand corner of the front panel are the STATUS and POWER indication LED's. The green power LED is illuminated whenever a 12 volt supply is connected to the transmitter. The orange status LED flashes at different rates to indicate the operational status of the transmitter, see table 2 for more details.

The front panel can be snapped out and removed by using a wide bladed flat screw driver to gain access to the configuration (console) port and programming switch. Photograph 2 below shows the front panel removed and the location of the console port and programming switch.



Photograph 2 Access to console port and programming switch

The black four pin console port connector and the red programming switch are located behind the lower right corner of the front panel label.

4 THEORY OF OPERATION

The four channel analogue transmitter takes four analogue inputs and transmits them onto the connected SILBUS network using either the ANALINK or FASTLINK protocols. Each analogue channel is converted to a sixteen bit (Fastlink) or eight bit (Analink) value ready for transmission on the configured SILBUS channel. The transmission protocol can be independently selected for each analogue input. 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 SILBUS-TX4A(G) 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 five configurable rising or falling set points. If the analogue input signal passes a set point level a digital alarm will be generated. This alarm can be configured to transmit on any valid SILBUS channel address.

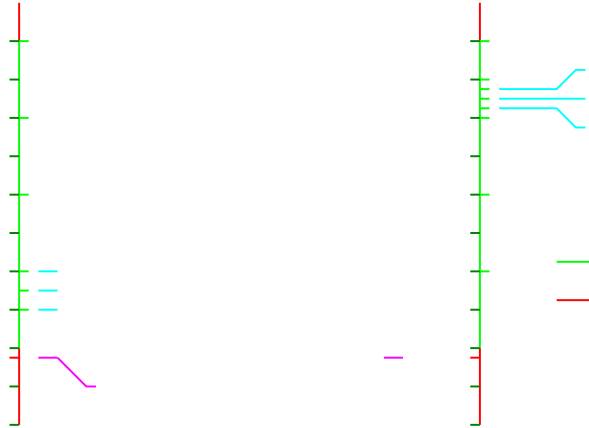


Figure 1 Set point and Fault operation

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.

An analogue input may be configured with just rising or just falling or both rising and falling set points; the maximum number of set points shall not exceed 5 for each input channel. Only one fault can be set per analogue input channel.

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.

5 OPERATING INSTRUCTIONS

The four channel analogue transmitter does not require any operator action to operate once it has been installed within an IP54 host enclosure and configured correctly.

An understanding of the various flash sequences of the orange status LED may be required to help in the trouble shooting and maintenance of the entire SILBUS network installation.

The status LED provides information on the operational status of the transmitter and the connected SILBUS network. This information includes correct microprocessor operation,

health of connected SILBUS network, selection of an invalid SILBUS channel address and indication of software version number. The table below shows the various flash sequences and their meaning.

STATUS LED FLASH SEQUENCES		
FLASH SEQUENCE	NAME	MEANING
NONE – LED ON OR OFF CONTINUOUSLY	NO FLASH	INTERNAL MICROPROCESSOR FAULT OR NOW POWER.
3 SECONDS ON 3 SECONDS OFF	SLOW FLASH	TRANSMITTER FUNCTIONING – NO SILBUS CONNECTED TO SILBUS PORT.
1 SECOND ON 1 SECOND OFF	FAST FLASH	TRANSMITTER FUNCTIONING – HEALTHY SILBUS CONNECTED TO SILBUS PORT.
LONG PERIOD OFF FOLLOWED BY 3 SHORT FLASHES	PAUSE – 3 SHORT FLASH	AN ANALOGUE INPUT, FAULT SIGNAL OR SET POINT HAS BEEN ASSIGNED TO AN INVALID SILBUS CHANNEL ADDRESS I.E. P5 FOR A 64 CHANNEL SILBUS NETWORK.
LONG PERIOD OFF FOLLOWED BY 4 SHORT FLASHES	PAUSE – 4 SHORT FLASH	AN ANALOGUE INPUT HAS BEEN CONFIGURED TO FASTLINK BUT A FASTLINK MARKER ADDRESS HAS NOT BEEN SPECIFIED.
LONG PERIOD OFF FOLLOWED BY 5 SHORT FLASHES	PAUSE – 5 SHORT FLASH	ONE OR MORE ANALOGUE INPUTS ARE BELOW THE CONFIGURED FAULT LEVEL e.g. 3.9mA
LONG PERIOD OFF FOLLOWED BY 6 SHORT FLASHES	PAUSE – 6 SHORT FLASH	A FASTLINK MARKER ADDRESS HAS BEEN SPECIFIED BUT THE MARKER CHANNEL IS NOT FUNCTIONING
MAJOR REVISION FLASH SEQUENCE – PAUSE – MINOR REVISION FLASH SEQUENCE	SOFTWARE VERSION SEQUENCE	INDICATES THE SOFTWARE VERSION LEVEL IMMEDIATELY AFTER POWER UP. SEE SOFTWARE REVISION SECTION OF THIS MANUAL FOR DETAILS.

Table 1 Status LED flash sequence meanings

The console port power source selection switch SW1 must always be in the run position for correct operation of the transmitter. The run position is with the small slide actuator pushed furthest away from the black four pin console connector X111.

6 CONFIGURATION

The four channel analogue transmitter 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 behind the front panel label. Access to the console port can be gained by snapping out the front panel using a wide bladed flat screw driver in one of the slots between the front panel and terminal blocks.

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 53-018-11.

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 3 Laptop connected to console port via MEAN1 interface

The SILBUS-TX4A certification places restrictions on what may be connected to the console port, the connection of an interface other than the Austdac MEAN1 to the console port will invalidate the certification of the transmitter.

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 SILBUS-TX4A, 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. **TX4A: :>**

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.

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:



TX4A::>HELP ↵

Software 2V01 0x07B9 Configuration 0x50E8 SN:00000000

Commands:

```
-----
                ***** Level 1: Standard Menu *****
HELP           [1..7] Level of Help                               Displays Help Menu
REPEAT         [LF] [Refresh rate in seconds]                   Repeats Previous Command
VER            Firmware Version and Checksum
STACK          Displays Peak Stack Usage
SBMAP          Displays SILBUS I/O Map
SBSTAT         Displays SILBUS Status
SBGET          <A1-P8>                                          Display a SILBUS Channel Status
SBADDR        [<SET> <ANA I/P> <A1-P8 or DISABLE>]              Set ANA I/P Address
SBFALT        [<SET> <ANA I/P> <A1-P8 or DISABLE>]              Set Fault Address
FLTLEV        [<SET> <ANA I/P> <mA Level>]                       Set Fault Level Value
ANASEL        [<SET> <ANA I/P> <ANALINK|FASTLINK>]              Set Analog Protocol
FSTMRK        [<SET> <A1-P8 or DISABLE>]                       Set Fastlink Marker Address
ADDPT         [<SET> <ANA I/P> <A1-P8> <F|R> <mA>]             Add 4-20mA Trip Points
DELPT         [<SET> <ANA I/P> <Number | All>]                   Delete 4-20mA Trip Points
HYST          [<SET> <mA Range>]                                  Set Hysteresis Range mA
AIN           [<ANA I/P>]                                       Display an Analog Input Value
CFGUP         Upload Configuration Text
CFGDWN        Download Configuration Text
-----
```

TX4A::>_

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 TX4A will respond by displaying the prompt.

TX4A::>SBGET D1 ↵

D1 = ON

TX4A::>REPEAT

D1 = OFF ↵

TX4A::>_

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:

TX4A::>REPEAT LF 5 ↵

D1 = OFF

```
D1 = OFF
D1 = ON
D1 = OFF
D1 = OFF
D1 = ON
D1 = OFF ↵
```

```
TX4A: :>_
```

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 COMMAND

The VERSION command is used to display the serial number, abbreviated type number, software version and program memory checksum of the TX4A. The command can be invoked as shown in the following example:

```
TX4A: :>VER ↵
SN:09124321 TX4A 1V01 0XB12F
```

```
TX4A: :>_
```

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 TX4A 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 TX4A was powered up. The command can be invoked as shown in the example below:

```
TX4A: :>STACK ↵
Stack usage/size = 312/1024
Percentage Used = 30%
```

```
TX4A: :>_
```

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

6.6 SILBUS MAP 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:

```
TX4A: :>SBMAP ↵
ABCDEFGHIJKLMNPO
0000000000000000
0000000000000000
0000000000000000
1000000000000000
0000000000000000
0000000000000000
0000000000000001
0000000000000001
```

```
TX4A: :>_
```

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

6.7 SILBUS STATUS 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:

```
TX4A: :>SBSTAT ↵
No. Chan = 128, Sync Count = 17807, Error Count = 0
```

```
TX4A: :>_
```

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.

6.8 SILBUS GET 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:

```
TX4A: :>SBGET M3 ↵
M3 = OFF
```

```
TX4A: :>SBGET B7 ↵
B7 = ON
```

TX4A::>_

6.9 ANALOGUE INPUT ADDRESS COMMAND

This command is used to display and configure the SILBUS channel addresses of the four analogue inputs of the SILBUS-TX4A. The current SILBUS channels can be displayed by simply entering the command name as shown in the example below:

```
TX4A::>SBADDR ↵  
Silbus Input Addresses are:  
Input 1 Address = J2  
Input 2 Address = A6  
Input 3 Address = A7  
Input 4 Address = B3
```

TX4A::>_

If the command name is entered with additional attributes the channel addresses can be configured to any valid SILBUS address. There is no restriction on the SILBUS addresses; they do not have to be in numerical order or from the same group. An example of configuring input 2 is shown below:

```
TX4A::>SBADDR SET 2 K7 ↵  
Setting Changed  
Input 1 Address = J2  
Input 2 Address = K7  
Input 3 Address = A7  
Input 4 Address = B3
```

TX4A::>_

The above example shows the format of the command when the address is configured. The keyword “SET” is required to invoke a change; the number of the TX4A input is next, followed by the SILBUS channel address. If a TX4A input is not to be used then it should not be assigned a SILBUS channel address. The keyword “DISABLE” is used when a SILBUS channel is not required.

```
TX4A::>SBADDR SET 2 DISABLE ↵  
Setting Changed  
Input 1 Address = J2  
Input 2 Address = DISABLE  
Input 3 Address = A7  
Input 4 Address = B3
```

TX4A::>_

6.10 FAULT ADDRESS COMMAND

This command is used to display and configure the SILBUS channel addresses of the four signal fault signals of the SILBUS-TX4A. The fault signals are generated when and

analogue input falls below a preconfigured fault level. The current SILBUS channels of the fault signals can be displayed by simply entering the command name as shown in the example below:

```
TX4A::>SBFALT ↵  
Under Level Fault Silbus Addresses are:  
Input [1] Fault Address = J2  
Input [2] Fault Address = A6  
Input [3] Fault Address = A7  
Input [4] Fault Address = B3
```

```
TX4A::>_
```

If the command name is entered with additional attributes the channel addresses can be configured to any valid SILBUS address. There is no restriction on the SILBUS addresses; they do not have to be in numerical order or from the same group. An example of configuring input 2 is shown below:

```
TX4A::>SBFALT SET 2 K7 ↵  
Setting Changed  
Input [1] Fault Address = J2  
Input [2] Fault Address = K7  
Input [3] Fault Address = A7  
Input [4] Fault Address = B3
```

```
TX4A::>_
```

The above example shows the format of the command when the address is configured. The keyword “SET” is required to invoke a change; the number of the TX4A input is next, followed by the SILBUS channel address. If a TX4A input is not to be used then it should not be assigned a SILBUS channel address. The keyword “DISABLE” is used when a SILBUS channel is not required.

```
TX4A::>SBFALT SET 2 DISABLE ↵  
Setting Changed  
Input [1] Fault Address = J2  
Input [2] Fault Address = DISABLE  
Input [3] Fault Address = A7  
Input [4] Fault Address = B3
```

```
TX4A::>_
```

6.11 FAULT LEVEL COMMAND

This command is used to display and configure the under level fault trigger point for each of the analogue inputs. The fault trigger point allows the analogue transmitter to detect input signals that are out of range (less than 4mA) or open circuit. The fault level is entered as a mA level for example 3.80. This would cause a fault to be generated whenever the input signal fell below 380mV for a 0.4 to 2.0V input signal or 3.80mA for a

4 to 20mA signal. The current fault levels can be displayed by simply entering the command name as shown in the example below:

```
TX4A::>FLTLEV ←  
Input [1] = 3.99mA  
Input [2] = 4.00mA  
Input [3] = 3.90mA  
Input [4] = 3.85mA
```

If the command name is entered with additional attributes the fault levels can be configured to any valid level. An example of configuring the fault level for input 2 is shown below:

```
TX4A::>FLTLEV SET 2 3.95 ←  
Setting Changed  
Input [1] = 3.99mA  
Input [2] = 3.95mA  
Input [3] = 3.90mA  
Input [4] = 3.85mA
```

6.12 TRIP POINT ADD COMMAND

This command is used to display and configure the SILBUS channel addresses, direction and level of the trip point alarms of the SILBUS-TX4A. The trip alarms are generated when an analogue input passes a preconfigured rising or falling trip point level. Up to five trip point alarms can be assigned to each analogue input. The current configuration of the set points can be displayed by simply entering the command name as shown in the example below:

```
TX4A::>ADDPT ←  
Analog Input 1  
1: G1 Trips on rising edge at 14.0mA  
2: G2 Trips on rising edge at 15.1mA  
3: G5 Trips on rising edge at 16.0mA  
4: G8 Trips on rising edge at 17.3mA  
5: !G3 Trips on rising edge at 18.0mA  
Analog Input 2  
No Set Points  
Analog Input 3  
No Set Points  
Analog Input 4  
1: J1 Trips on falling edge at 16.5mA  
2: J2 Trips on falling edge at 16.0mA
```

```
TX4A::>_
```

Analogue input 1 has 5 rising trip points; the fifth is inverted as indicated by the exclamation mark. Inverted set points normally transmit on the nominated digital channel and stop transmitting when the input signal passes the set point, allowing for fail safe operation. Analogue inputs 2 and 3 in the above example do not have any set points configured. If the command is entered with additional attributes more set points can be

added to the configuration up to the upper limit of five set points per input channel. There is no restriction on the SILBUS addresses; they do not have to be in numerical order or from the same group. An example of adding a new set point to input 2 is shown below:

```
TX4A::>ADDPT SET 2 H2 R 6.3 ↵
Setting Changed
Analog Input 1
  1: G1 Trips on rising edge at 14.0mA
  2: G2 Trips on rising edge at 15.1mA
  3: G5 Trips on rising edge at 16.0mA
  4: G8 Trips on rising edge at 17.3mA
  5: !G3 Trips on rising edge at 18.0mA
Analog Input 2
  1: H2 Trips on rising edge at 6.3mA
Analog Input 3
  No Set Points
Analog Input 4
  1: J1 Trips on falling edge at 16.5mA
  2: J2 Trips on falling edge at 16.0mA
```

```
TX4A::>_
```

The above example shows the adding of a set point to analogue input 2. The keyword “SET” is required to invoke an addition; the address of the SILBUS digital channel is next, followed by the keyword “R” for rising alarm and the value of the set point level in milliamps. The exclamation mark should be used in front of the channel address if inverted transmission is required i.e. fail safe operation. The set point value can be any value between 4.0mA and 20.0mA in 0.1mA steps.

6.13 SET POINT DELETE COMMAND

This command is used to display or delete set points from the analogue inputs. The current configuration of the set points can be displayed by simply entering the command name as shown in the example below:

```
TX4A::>DELPT ↵
Analog Input 1
  1: G1 Trips on rising edge at 14.0mA
  2: G2 Trips on rising edge at 15.1mA
  3: G5 Trips on rising edge at 16.0mA
  4: G8 Trips on rising edge at 17.3mA
  5: !G3 Trips on rising edge at 18.0mA
Analog Input 2
  1: H2 Trips on rising edge at 6.3mA
Analog Input 3
  No Set Points
Analog Input 4
  1: J1 Trips on falling edge at 16.5mA
  2: J2 Trips on falling edge at 16.0mA
```

TX4A::>_

The use of the set point delete command without any attributes does not delete any set points.

TX4A::>DELPT SET 1 3 ←

Analog Input 1

- 1: G1 Trips on rising edge at 14.0mA**
- 2: G2 Trips on rising edge at 15.1mA**
- 3: G8 Trips on rising edge at 17.3mA**
- 4: !G3 Trips on rising edge at 18.0mA**

Analog Input 2

- 1: H2 Trips on rising edge at 6.3mA**

Analog Input 3

No Set Points

Analog Input 4

- 1: J1 Trips on falling edge at 16.5mA**
- 2: J2 Trips on falling edge at 16.0mA**

TX4A::>_

The above example shows the deletion of the third set point on analogue input 1. The keyword “SET” is required to invoke the deletion. The number “1” specifies the analogue input and the “3” specifies which set point to delete. Note that set points four and five are renumbered after execution of the delete command. The next example shows the use of the keyword “ALL” with the delete set point command.

TX4A::>DELPT SET 1 ALL ←

Analog Input 1

No Set Points

Analog Input 2

- 1: H2 Trips on rising edge at 6.3mA**

Analog Input 3

No Set Points

Analog Input 4

- 1: J1 Trips on falling edge at 16.5mA**
- 2: J2 Trips on falling edge at 16.0mA**

TX4A::>_

6.14 HYSTERESIS COMMAND

This command is used to display and configure the fault and set point hysteresis value for all of the analogue inputs. The hysteresis value is used to stop the fault signal from switching on and off with any noise that may be present on the analogue input signal. For example if the analogue input was currently at 4.00mA and the fault level was set at 3.99mA, the input signal would only need slightly more than 0.01mA of noise to cause the fault signal 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

hysteresis value is common to all four analogue inputs, faults and set points. The current hysteresis value can be displayed by simply entering the command name as shown in the example below:

```
TX4A::>HYST ↵  
Hysteresis level 0.10mA
```

```
TX4A::>_
```

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:

```
TX4A::>HYST SET 0.21 ↵  
Setting Changed  
Hysteresis level 0.21mA
```

```
TX4A::>_
```

The range of the hysteresis is from 0.01mA to 1.00mA.

6.15 ANALOGUE SELECT COMMAND

This command is used to display and configure the analogue transmission protocol for each of the analogue inputs. Each analogue input can be configured to either Analink or Fastlink. The current selected transmission protocols can be displayed by simply entering the command name as shown in the example below:

```
TX4A::>ANASEL ↵  
Chan[1] = Analink  
Chan[2] = Analink  
Chan[3] = Analink  
Chan[4] = Analink
```

```
TX4A::>_
```

If the command name is entered with additional attributes the analogue transmission protocol can be configured to Fastlink or Analink for each analogue input. An example of configuring input 1 is shown below:

```
TX4A::>ANASEL SET 1 FASTLINK ↵  
Setting Changed  
Chan[1] = Fastlink (Marker Error)  
Chan[2] = Analink  
Chan[3] = Analink  
Chan[4] = Analink
```

```
TX4A::>_
```

The 'marker error' has been displayed because analogue input one has been configured to Fastlink but a valid Fastlink marker channel address has not been specified. See the Fastlink marker command (FSTMRK) for details on assigning a valid marker address.

Once a valid marker address has been configured the error message will disappear as shown in the example below.

```
TX4A::>ANASEL ←  
Chan[1] = Fastlink  
Chan[2] = Analink  
Chan[3] = Analink  
Chan[4] = Analink
```

```
TX4A::>_
```

6.16 ANALOGUE INPUT COMMAND

The analogue select command is used to display the current value of the selected analogue input. The example below shows analogue input 3 being displayed:

```
TX4A::>AIN 3 ←  
Chan[1] = 12.230mA
```

```
TX4A::>_
```

If the input attribute is omitted from the command then the last displayed input will be displayed again. If the analogue input command has not been used since power up and the input attribute is omitted from the command then input one will be displayed by default.

6.17 FASTLINK MARKER COMMAND

This command is used to display and configure the FASTLINK marker SILBUS channel address. A valid FASTLINK marker is required whenever any one of the analogue inputs is configured to transmit using the FASTLINK protocol. 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:

```
TX4A::>FSTMRK ←  
Fastlink Marker SILBUS Address is A3
```

```
TX4A::>_
```

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 TX4A transmitter then the marker channel should be disabled. The keyword “DISABLE” is used when the marker channel is not required.

```
TX4A::>FSTMRK SET DISABLE ←  
Setting Changed  
Fastlink Marker SILBUS Address is DISABLE
```

```
TX4A::>_
```

The following table may be used to record the configuration of the SILBUS-TX4A four channel analogue transmitter.

6.18 UPLOAD CONFIGURATION COMMAND

The upload configuration command is used to extract the configuration profile of the SILBUS-TX4A 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 SILBUS-TX4A transmitters for maintenance or system expansion. The upload is invoked by entering the command name without any attributes as shown in the example below.

```
TX4A: :>CFGUP ←
CFGDWN
S00300000FC
S11300000000001001022E008056000105000000CF
S11300108000000080000000800000008000000DC
S11300208000140008001E00090028000A000000D7
S113003080000000800000006492000011002ED9AE
S9030000FC
```

```
TX4A: :>_
```

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. TX2F_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.

```
TX4A: :>CFGUP ←
CFGDWN
S00300000FC
S11300000000001001022E008056000105000000CF
S11300108000000080000000800000008000000DC
S11300208000140008001E00090028000A000000D7
S113003080000000800000006492000011002ED9AE
S9030000FC
```

```
TX4A: :>_
```

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.

6.19 DOWNLOAD CONFIGURATION COMMAND

The download configuration command is used to take a previously saved configuration from a file and download it to the target SILBUS-TX4A transmitter. 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 SILBUS-TX4A prompt as follows.

TX4A: :>_

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

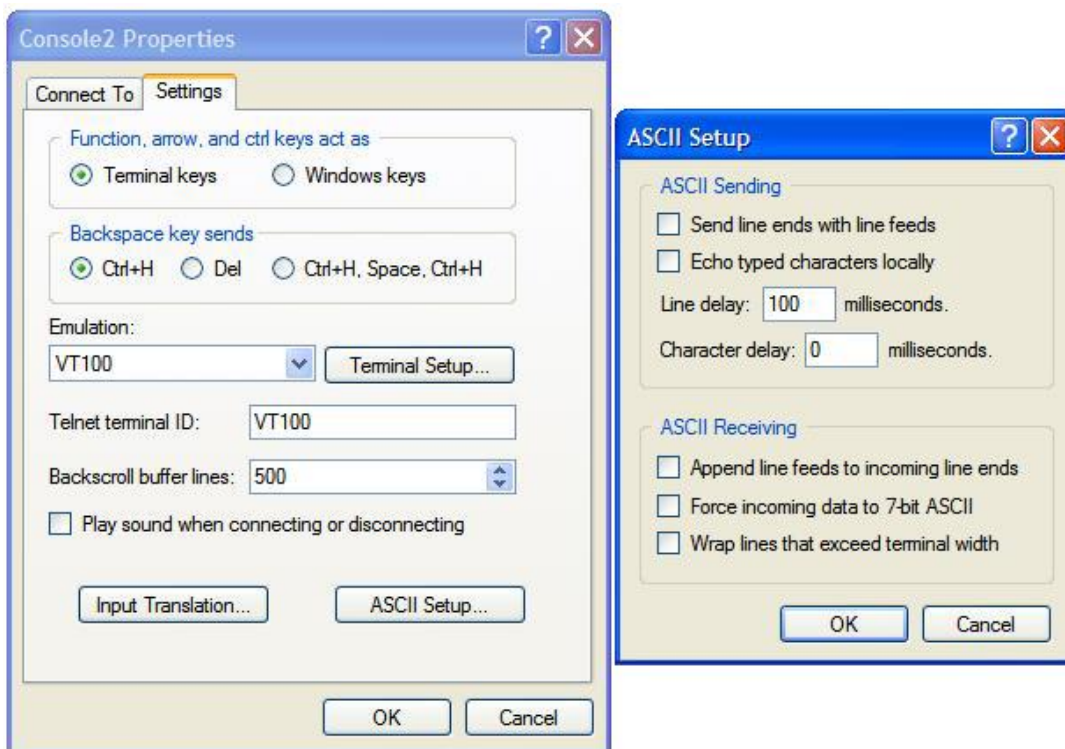
```
CFGDWN  
S00300000FC  
S11300000000001001022E008056000105000000CF  
S11300108000000080000000800000008000000DC  
S11300208000140008001E00090028000A000000D7  
S113003080000000800000006492000011002ED9AE  
S9030000FC
```

Copy and paste the configuration from Notepad to the TX4A::> prompt in Hyper Terminal as shown below. Note CTRL-V does not work in Hyper Terminal.

```
TX4A: :>CFGDWN  
S00300000FC  
S11300000000001001022E008056000105000000CF  
S11300108000000080000000800000008000000DC  
S11300208000140008001E00090028000A000000D7  
S113003080000000800000006492000011002ED9AE  
S9030000FC↵
```

TX4A: :>_

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 4 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.

SILBUS-TX4A(G) CONFIGURATION RECORD				
LOCATION				
SILBUS NETWORK				
CONFIGURATION CHECKSUM				
CHANNEL	1	2	3	4
INPUT SIGNAL TYPE ¹				
ANALOGUE SILBUS ADDRESS				
FAULT SILBUS ADDRESS				
FAULT LEVEL (mA)				
HYSTERESIS				
SET POINT 1 TYPE AND LEVEL (mA) ¹				
SET POINT 2 TYPE AND LEVEL (mA) ¹				
SET POINT 3 TYPE AND LEVEL (mA) ¹				
SET POINT 4 TYPE AND LEVEL (mA) ¹				
SET POINT 5 TYPE AND LEVEL (mA) ¹				
ANALOGUE TRANSMISSION TYPE				
FASTLINK MARKER SILBUS ADDRESS				
NOTE 1 – CURRENT INPUTS AND SET POINTS NOT AVAILABLE IN SILBUS-TX4AG				

Table 2 SILBUS-TX4A Configuration record

7 TERMINATIONS AND CONNECTIONS

All connections to the four channel analogue transmitter are via cage-clamp terminals around the perimeter and near the front of the DIN rail mounting enclosure, these terminals can accommodate up to 4mm² conductors. There are 16 possible connections to the transmitter; these are shown in the following tables and diagrams:

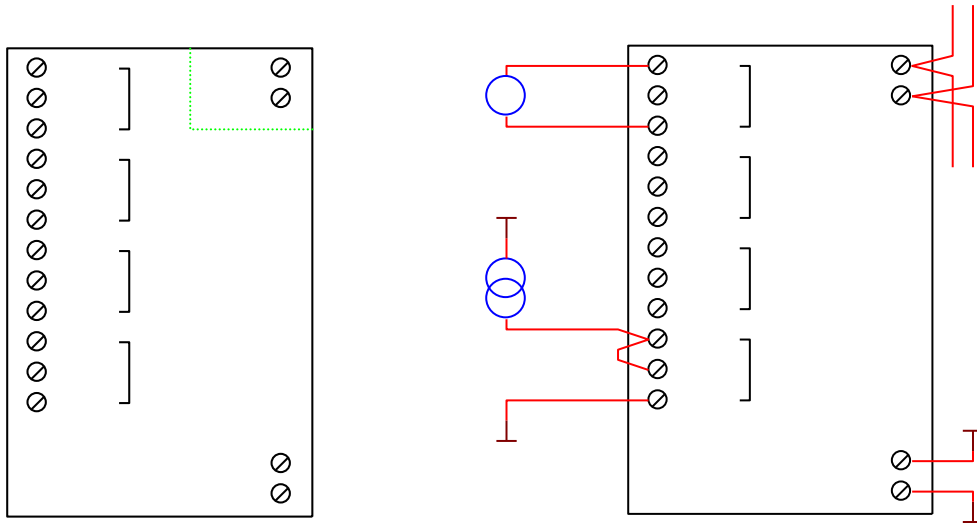


Figure 2 SIBUS-TX4A Connection diagram

7.1 ANALOGUE INPUT PORTS

Each analogue input is provided with three terminals for the connection of field wiring. Each input can accept a voltage or current type signal depending on the way the field wiring is terminated at the transmitter. For voltage type input signals the 'HI' and 'LO' input terminals are used as shown for channel one in figure 1 above. For current type signals the 'HI' and 'LO' input terminals are also used with an added link between the 'HI' and 'I to V' terminals as shown for channel four in figure 1 above. By linking the 'HI' and 'I to V' terminals a 100Ω current to voltage converting resistor is connected across the input of the transmitter.

ANALOGUE INPUT TERMINATIONS			
INPUT	TERM #	LABEL	DESCRIPTION
CH1	16	HI	CHANNEL 1 HI or +VE INPUT
	17	I to V	CHANNEL 1 CURRENT TO VOLTAGE CONV RESISTOR INPUT
	18	LO	CHANNEL 1 LO or -VE INPUT
CH2	19	HI	CHANNEL 2 HI or +VE INPUT
	20	I to V	CHANNEL 2 CURRENT TO VOLTAGE CONV RESISTOR INPUT
	21	LO	CHANNEL 2 LO or -VE INPUT
CH3	22	HI	CHANNEL 3 HI or +VE INPUT
	23	I to V	CHANNEL 3 CURRENT TO VOLTAGE CONV RESISTOR INPUT
	24	LO	CHANNEL 3 LO or -VE INPUT
CH4	25	HI	CHANNEL 4 HI or +VE INPUT
	26	I to V	CHANNEL 4 CURRENT TO VOLTAGE CONV RESISTOR INPUT
	27	LO	CHANNEL 4 LO or -VE INPUT

Table 3 Analogue input termination details

When a link is placed between the 'HI' and 'I to V' terminals of an input it is converted to a current type input with a 100Ω current to voltage conversion resistor across the input. This resistor will convert 4-20mA signals to 0.4-2.0V signals at the 'HI' and 'LO' terminals.

The analogue inputs are galvanically isolated from the SILBUS network port; this allows the SILBUS-TX4A to be used in a variety of special ways that include connecting non-intrinsically safe signals to the analogue inputs while the transmitter is connected to an intrinsically safe SILBUS network.

7.2 POWER INPUT PORT

The four channel analogue transmitter operates from a nominal 12 volt DC supply. The power supply operating range is from 7.5 volts through to 12.6 volts. The SILBUS-TX4A consumes less than 12mA from the power supply. The table below shows the power input port connection details.

POWER INPUT PORT TERMINATIONS		
TERMINAL	DESIGNATION	DESCRIPTION
14	+VE 12V	POWER SUPPLY +VE INPUT
15	-VE 12V	POWER SUPPLY -VE OR COMMON INPUT

Table 4 Power input port termination details

7.3 SILBUS NETWORK PORT

The SILBUS network port provides a means for the transmitter 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.

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

Table 5 SILBUS network port termination details

The table above shows the SILBUS network port connections.

8 CERTIFICATION

The four channel analogue transmitter type SILBUS-TX4A has been awarded IECEx certification under IECEx TSA 07.0002X, Ex ia I, as part of the Dupline / SILBUS system.

The certification requires that the SILBUS-TX4A be mounted within a host enclosure that provides a minimum ingress protection of IP54 (IP55 for Queensland Australia).

Because of the segregation and isolation between the analogue inputs and the SILBUS network port the SILBUS-TX4A may be easily used in an installation without having to consider any Ex interaction between the SILBUS network and the analogue inputs. The SILBUS network port is segregated from the other ports to IEC60079-11 375 volts. The four analogue input channels are segregated from each other but not galvanically isolated. Refer to drawing 120-396-19 for more detail on the application of the SILBUS-TX4A(G).

The analogue input terminals are separated from all other terminals by more than 50mm. The individual analogue input channels are separated from each other by more than 6mm.

This certification allows the four channel analogue transmitter to be located wholly within the hazardous area and the connection of intrinsically safe circuits to its various ports. The analogue inputs can be driven from a single or four different intrinsically safe sources because of the segregation between the four analogue input channels. For the same reason the power supply port can be driven from the same source as the analogue inputs or from an entirely different intrinsically safe source without the need for an assessment of voltage or current addition.

As always, careful attention should be paid to the segregation of wiring in this configuration as incorrectly segregated wiring could negate the segregation and safety of the transmitter.

9 SILBUS-TX4AG VARIANT

The SILBUS-TX4AG variant of the SILBUS-TX4A is exactly the same as the SILBUS-TX4A except it has been rescaled to **only** accept a 0.44-2.2V analogue signal generated by a TROLEX TX9042 current type analogue input card. The SILBUS-TX4AG can only transmit the 0.44-2.2V voltage signal and can not transmit current type analogue inputs.

The SILBUS-TX4AG variant is only used in conjunction with a TX9042 current type analogue input card as shown in the figure below.

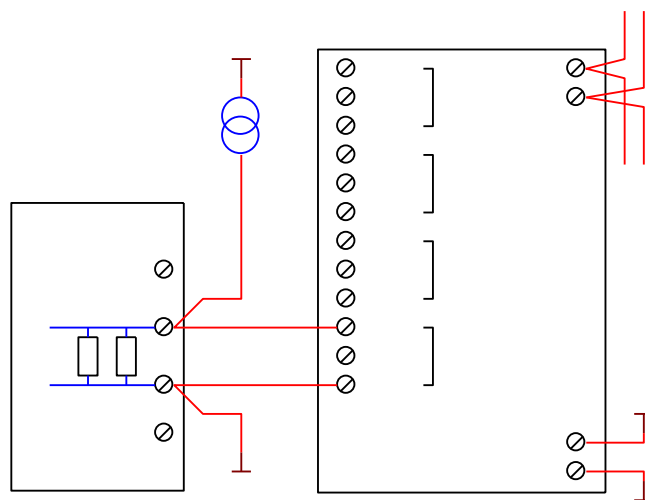


Figure 3 SILBUS-TX4AG connected to a TX9042

The application of using the 110Ω ±5% sampling resistor within the TX9042 current input card to convert the 4-20mA signal into a 0.44-2.2V for retransmission via the SILBUS-TX4AG introduces a 5% error into the signal. For this reason the SILBUS-TX4AG should only be used as a maintenance replacement for the discontinued ATX4AG. The SILBUS-TX4AG should not be used for new designs. The SILBUS-TX4AG does not have set point trip alarms.

10 SOFTWARE REVISION AND DISPLAY

The software version of the four channel analogue transmitter type SILBUS-TX4A 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 console port or by watching the orange status LED immediately after power up. The software version will be indicated by a sequence of longer flashes for the major revision level, a long pause to indicate the decimal point and a further sequence of shorter flashes representing the minor revision level. Therefore software version 1.12 would be represented by the sequence “one longer flash, a long pause, followed by 12 shorter flashes”. Refer to the SILBUS-TX4A software release register (120-399-01) for a history of software / firmware updates.



11 SPECIFICATIONS

Name	4 Channel Analogue Transmitter
Type.....	SILBUS-TX4A(G)
Number of analogue channels	4
Analogue input current signal range (TX4A)	4 – 20mA
Analogue input voltage signal range (TX4A)	0.4 – 2.0V
Analogue input current to voltage conversion resistance (TX4A)	100Ω 0.1%
Analogue input current signal range (TX4AG)	not available
Analogue input voltage signal range (TX4A)	0.44 – 2.2V
Analogue input current to voltage conversion resistance (TX4AG)	not available
Analogue transmission protocol	FASTLINK or ANALINK
Signal faults per analogue input (TX4A and TX4AG)	1
Set points per analogue input (TX4A only)	5
Set point type (TX4A only)	Rising or Falling
Console port configuration	19200 baud, 8 data, 1 stop, No parity
Terminations	Cage clamp 4mm ² maximum
Size.....	100mm (W) x 75mm (H) x 110mm (D)
Mass	300g
Fixing.....	TS35 DIN rail or screw mount M4 on 85mm x 61mm centres
Ingress protection	IP20
Enclosure material	Polycarbonate (30%GV) UL 94 V-1
Enclosure colour	RAL 7032 Grey
Terminal material	Polycarbonate UL 94 V-2
Terminal block colour	Blue
Operating temperature range	0°C to 40°C
Storage temperature range	-20°C to 80°C
Operating relative humidity range	10% to 90% Non condensing
Power supply operating voltage range	7.5v to 12.6v
Power supply current consumption	12mA maximum
Pollution Degree	2
Installation Category	1
Altitude.....	2000m



Humidity80% to temperatures up to 31°C
..... decreasing linearly to 50%rH at 40°C.
.....max 80% rH, non-condensing