Profibus Interface Manual for Sonologic II

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NOTICE

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Chapter 1. Introduction

This manual covers the installation, setup, and programming for the Sonologic II Profibus-DP slave. This slave complies to the Profibus Standard EN 50170. EN 50170 is an open, vendor-independent communication standard, which defines the technical and functional characteristics of a serial Fieldbus. It interconnects distributed digital field devices in the low to medium performance range.

Profibus-DP (Decentralized Periphery) is the Profibus option that provides the optimum combination of data throughput, ease of installation and service, diagnostic capabilities, and error-free transmission. This option is dedicated to time-critical communication between automation systems and distributed peripherals such as the Sonologic II signal processor.

In a Profibus network, **master devices** control the bus and are called “active stations.” A master can transfer messages without remote request. **Slave devices** are simple peripheral devices, such as sensors, actuators, and transmitters. They are called “passive stations” and have no bus access rights. For example, they may only acknowledge received messages, or at the request of a master, transmit messages to that master.

The Sonologic II Profibus-DP Slave

The Sonologic II monitors up to a total of 16 Sonocell transducers of various frequencies, accommodating multiple vessels of different heights and shapes for level, flow, and DLD applications. It includes the following features:

- Supports the Profibus-DP (Decentralized Periphery) standard.
- Allows access to data, calibration parameters, and tuning parameters from the Programmable Logic Controller (PLC), or Personal Computer (PC).
- Allows setup and tuning parameters to be uploaded/downloaded for system backup archival.
- Offers a selection of commands and summaries for best meeting operational requirements.
- Allows remote programming, setup, calibration, tuning, diagnosis, and archival via the Profibus network.

The Kistler-Morse Profibus-DP Card

The Sonologic II Profibus-DP slave includes a high-speed interface card using the Siemens SPC3 chip set and RS485 transmission technology. The bus structure permits the addition and removal of stations or step-by-step commissioning of the system. The card has the following capabilities and requirements:

Sonologic II compatibility EEPROM must be Rev. P or higher.

Transmission speed Between 9.6 kbit/sec. and 12 Mbit/sec. The Sonologic II Profibus DP card will auto-select the speed of the bus.

Network topology Linear bus, active bus termination on both ends, stub lines only permitted for baud rates of ≤ 1.5 Mbit/sec. (Termination not supplied)

Medium Shielded twisted-pair cable. Siemens 6XV1-830-OAH10, Belden 3079A, or equivalent.

Number of stations 126 stations on one bus.

Connector 9-pin D-sub plug connector. Siemens Bus Connector 6ES7-972-OBA11-OXAO or equivalent.

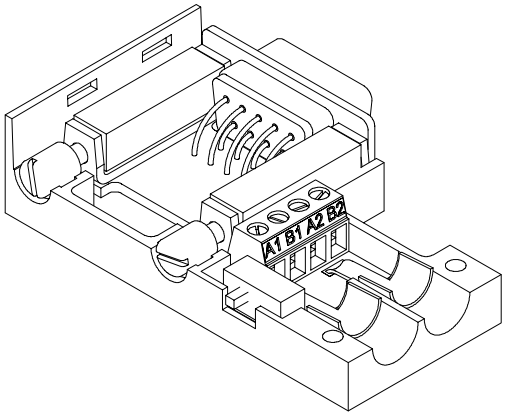


Figure 1-1. Seimens Bus Connector

Cable pin definition

D-sub shell – Ground (outerbraided shield)

Pin 3 – Signal “B1/B2” (Red) Pin 4 – RTS Signal

Pin 5 – Data ground Pin 6 – 5VDC

Pin 8 – Signal “A1/A2” (Green)

	9.6k-167.5k BAUD	500k BAUD	1.5m BAUD	3-12m BAUD
Per segment	1000m/3937ft	400m/1312ft	200m/656ft	100m/328ft
With repeater	10,000m/3937ft	400m/1312ft	200m/656ft	100m/328ft
Per fiber optic segment	15km/9 mi.	15km/9 mi.	15km/9 mi.	15km/9 mi.
Total with fiber optic	> 200km/124 mi.	> 200km/124 mi.	> 200km/124 mi.	130km/80 mi.

Chapter 2. Installing Hardware

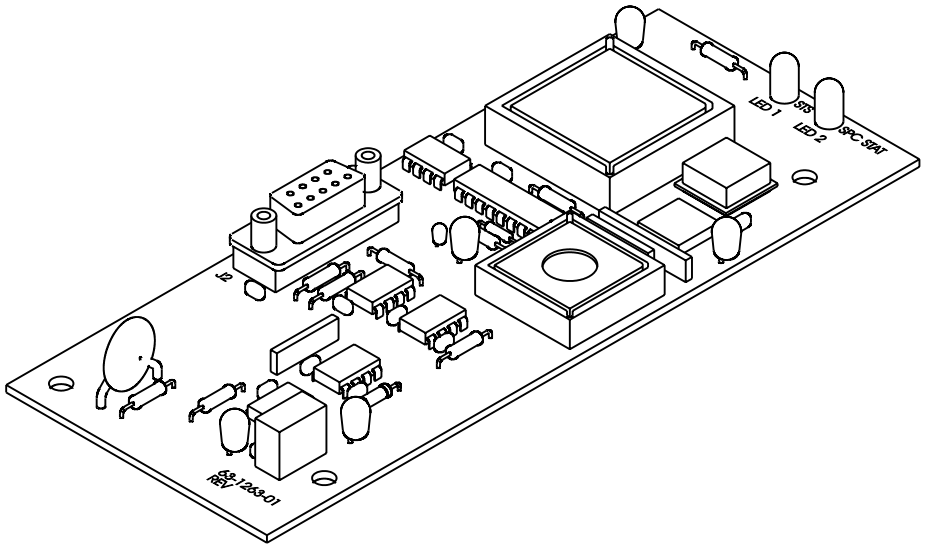


Figure 2-1. Kistler-Morse Profibus-DP Card

This chapter covers the installation and setup of the Sonologic II Profibus-DP card. Typically, the card comes already connected to the Sonologic II **(Sonologic II EEPROM Rev. P or higher)**. To obtain a card for an older version Sonologic II, request Kit number 73-0100-01 from Kistler-Morse to upgrade.

Note

For installation, setup, and calibration of the Sonologic II, refer to the *Sonologic II and Sonocell Installation and Operation Manual* (part 97-1119-01).

Wiring

A shielded twisted-pair cable generally connects Profibus-DP slaves. The shield has to be connected to the protective housing of the connector, which is then brought to ground via the connection on the device.

Connect the wires to the Seimens Bus Connector

When connecting the wires to the Seimens Bus connector, care must be taken that the shield and wires are properly installed. The two wires are usually color-coded red and green. Red is for the B Transmit and Receive Line (B1, B2), and green is for the A Transmit and Receive Line (A1, A2). See Figure 1-1.

It is very important that the selection for A and B Lines are used consistently throughout the network to avoid improper operation. This is the most common connection mistake in the field.

Connect the cable and connector to the Profibus-DP card

1. Cut a hole in the bottom of the box as required to fit the Profibus cable and Seimens Bus connector.

2. Run the cable with the connector through the hole and push the connector into J2 (9-pin D-sub male Siemens Bus Connector 6ES7-972-OBA11-OXAO or equivalent).

Termination

Each Profibus segment needs to be terminated at the beginning and end of a segment. The ideal case is to have one end of the network connected to the master with the termination on.

Preferably, the master device is installed as the start of the network and as a termination point. If repeaters are used, the repeater is at the start and end of the network and is the termination point as well.

LED Indicators

The Red and Green LED lights on the DP-Slave indicate the status of the Profibus connection. The Red LED is CR1 STS and the Green LED is CR2 SPC STAT.

Possible status indications are as follows in Table 2-1:

GREEN	RED	Meaning
ON	Flash	Profibus connection is active. Red LED flashes to indicate data flow.
ON	OFF	Connection active with DP-Master. However, DP-Slave is not transferring data. Check for Rev. P or higher on Sono II.
OFF	OFF	DP-Slave is not powered or hardware failure.
OFF	1x Flash	DP-Slave is waiting to autobaud. Indicates missing or bad connection with DP-Master. Check wiring.
OFF	2x Flash	DP-Slave is waiting to be addressed. Check DP-Master in config software and verify it matches DP-Slave address.
OFF	3x Flash	DP-Slave has bad parameter or has lost connection. Check the GSE file was properly imported and used to configure the DP-Slave.
OFF	Other Flash	DP-Slave hardware had an error initializ-ing.

Table 2-1. LED Meanings

Addressing

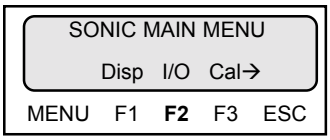
The user must give the Profibus-DP card a unique node address using the PLC menu.

Follow the instructions to input the correct address.

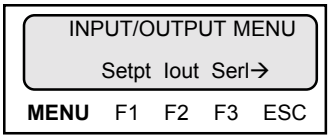
To address the Profibus-DP card

*If the Sonologic II is in AUTO mode (AUTO LED on), press the **AUTO/MAN** key to put the sytem into MANUAL mode.*

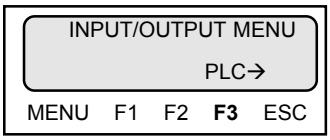
1. Press the **Menu** key to display the main menu.



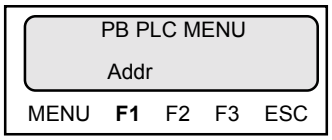
2. Press the **F2** key to display the INPUT/ OUTPUT menu.



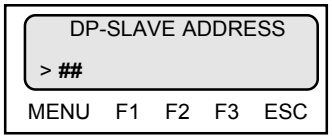
3. Press the **Menu** key to display the second page of the MENU.



4. Press the **F3** key to display the PB PLC menu.



5. Press the **F1** key to choose an address. The default address will display.



6. Use the numeric keypad to overwrite the default address with the correct address, and press ENTER.

7. Press the **Esc** key to scroll up the menu tree, or press the **Auto/Man** key once to return to vessel monitoring or twice to return to the AUTO mode.

Chapter 3. Programming

Introduction

This chapter describes programming options for the Sonologic II Profibus-DP slave. This material is for users who have an understanding of PLC programming and Profibus. For specific instructions, refer to your configuration software documentation.

The GSD File

The Profibus GSD file, "KM__089F.gsd," describes the configuration for this slave device. (For english translation, the .gse file may be used.) The file is on the floppy disk that accompanies the Profibus-DP card. It is also on the Web at: http://www.kistlermorse.com/document.htm.

Configuration

The Profibus-DP slave is a modular slave that can be configured with any number of input or output words, up to a maximum of 122 words combined. With the GSD file imported into the configuration software, the input and output words can be selected and mapped to the PLC I/O.

Parameter Options

The following Profibus device parameters may be set using your Profibus configuration software. The *Custom* interface method applies the greatest number of parameters and are unneccessary in the *Standard* and *Request + Reply* interface.

Parameter Name	Options	Description
Significant Byte Order	MSB before LSB LSB before MSB	Sets the byte order for words and long words. The majority of PLC's (S5, S7) utilize the MSB (Most Significant Byte) before LSB (Lowest Significant Byte) order; however, some PLC's utilize the LSB before MSB. Setting this option will swap the byte order.
Interface Method	Standard Custom Request + Reply	Sets the interface method used.
Starting Input Word	0-110	Sets the starting custom word for the PLC inputs when using the custom interface or *Request + Reply* interface. The custom words 0 to 110 are parameterized below.
Starting Output Word	0-110	Sets the starting custom word for the PLC outputs when using the custom interface or *Request + Reply* interface. The custom words 0 to 110 are parameterized below.
Custom Word 0 Channel	0-16	Sets the channel number for Custom Word 0.
Custom Word 0 Data Type	0-255	Sets the data type for Custom Word 0.
Custom Word *n* Channel	0-16	Sets the channel number for Custom Word *n*. There are 111 custom words that may be used for both a custom input and a custom output.
Custom Word *n* Data Type	0-255	Sets the data type for Custom Word *n*. There are 111 custom words that may be used for both a custom input and a custom output. For descriptions of the data types, refer to the Sonologic II Data Types section.

Table 3-1. Parameterization Options

Interface Method

This section describes the three possible interface methods: *Standard*, *Custom*, and *Request + Reply*. The interface is selected with the *Interface Method* parameter. The *Standard* interface is simple I/O, providing level data. The *Custom* interface provides a customized I/O defined by the parameterization. The *Request + Reply* interface requires some PLC logic but provides the power to backup and restore Sonologic II parameters.

Standard

The *Standard* interface is the default and gives level data and echo loss bits at the PLC inputs. Use this interface to read continuous level data for each channel. The first input word is Echo Loss Bits, and is updated on every channel. If the inputs and outputs are mapped to IW0 (input word) and QW0 (output word), the following words result as shown in Table 3-2:

	Output Words		Input Words
QW0	*Unused*	IWO	Echo Loss Bits
QW2	*Unused*	IW2	Channel 1 Level
QW4	*Unused*	IW4	Channel 2 Level
QW6	*Unused*	IW6	Channel 3 Level

(for up to 16 channels)

Table 3-2. Standard Interface Example

Custom

The *Custom* interface provides access to extra data types in a custom format defined by the Profibus parameterization. Use this interface to read or write additional data types such as temperature or setpoint relays.

With the *Custom* interface, each input and output words are custom words and may be assigned a data type and a channel number. The *Starting Input Word* parameter sets the custom word number for the first configured PLC input. Similarly, the *Starting Output Word* parameter sets the custom word number for the first configured PLC output. *Note that Inputs and Outputs may overlap and use the same custom words.*

The parameters *Custom Word "n" Channels* are numbered 1 through 16, representing each channel. However, a channel 0 causes a write to all channels or a read input to be updated with whichever channel is the current Sonologic channel taking a measurement. For descriptions of the possible data types, refer to the Sonologic II Data Types section. *Note that some data types are longer than one word in length.* To access all elements of a multiple word data type, simply set consecutive custom words to the same data type. Table 3-3 below is an example of parameters for the *Custom* interface. The parameters that determine the first output words are highlighted.

Parameter Name	Options	Example
Interface Method		Custom
Starting Input Word	0-110	**0**
Starting Output Word	0-110	**50**
Custom Word 0 Channel	0-16	**1**
Custom Word 0 Data Type	0-255	**0**
Custom Word 1 Channel	0-16	**2**
Custom Word 1 Data Type	0-255	**0**
Custom Word 2 Channel	0-16	**3**
Custom Word 2 Data Type	0-255	**4**
(custom words 3 to 49)		
Custom Word 50 Channel	0-16	**3**
Custom Word 50 Data Type	0-255	**3**
Custom Word 51 Channel	0-16	**2**
Custom Word 51 Data Type	0-255	**5**
Custom Word 52 Channel	0-16	**1**
Custom Word 52 Data Type	0-255	**5**
(custom words 53 to 110)		

Determines Output Word 0

Output Words	Input Words
QW0 Channel **3** type **3**	IW0 Channel **1** type **0**
QW1 Channel **2** type **5**	IW1 Channel **2** type **0**
QW2 Channel **1** type **5**	IW2 Channel **3** type **4**

(for up to 16 channels)

Table 3-3. Custom Interface Example

Request + Reply

The *Request + Reply* interface uses the first input and output word to define the format of the inputs and outputs. Use this interface to backup and restore Sonologic II parameters, or when the *Standard* and *Custom* interfaces do not provide enough flexibility.

On the floppy disk that accompanies the Profibus-DP card is sample Step7 (S7 PLC) logic that will backup and restore the Sonologic II parameters using the *Request + Reply* interface. This interface defines the first output word as the request and the first input word as the reply. The request and the reply words have the same bit format defined in Table 3-4.

When requesting to read data, the PLC sets the request word with the desired input format, (RW =0). After the Sonologic II has updated the PLC inputs, it sets the reply equal to the request. Note the inputs are updated continuously.

When writing data, the PLC first sets the outputs with the data to be written. Then the PLC sets the request (RW =1) and the Sonologic II will latch in the outputs. After the outputs are written, the Sonologic II will set the reply equal to the request and will not accept more outputs again until it has a new request.

There are 4 formats of the requested data: 0) One word, 1) Sequential channel, 2) Next Element, and 3) Custom Data pages.

MSB **LSB**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RW	FMT	FMT	CH	CH	CH	CH	CH	TP	TP	TP	TP	TP	TP	TP	TP

Bits	Values	Description
RW	0-1	Read or Write 0 = Read 1 = Write
FMT	0-3	Word Formats 0 = One Word 1 = Sequential channel 2 = Custom data pages 3 = Next element
CH	0-31	Channel Number 0 = All Channels 1-16 = Channel 1-16
TP	0-255	Data Type

Table 3-4. Request Word and Reply Word Format

One Word

The *One Word Request + Reply* format is used to read and write one word at a time. When requesting to read data one word at a time (RW =0, FMT =0), the input data is the input word following the reply. When writing data (RW =1, FMT =0), the output data is the output word following the request.

There are 16 channels (numbered 1-16) in the request (CH). However, a channel 0 causes a write to all channels or a read input to be updated with whichever channel is the current Sonologic channel taking a measurement. For descriptions of the possible data types, refer to the Sonologic II Data Types section. Note that a few data types are longer than one word and will require alternating with the *Next Element* format (FMT =3). Table 3-5 provides some examples.

	Output Words	Input Words
QW0	Request: RW=0, FMT=0	IW0 Reply
	CH=1, TP=0	
QW2		IW2 Channel **1** type **0**
QW4		IW4

	Output Words	Input Words
QW0	Request: RW=1, FMT=0	IW0 Reply
	CH=3, TP=5	
QW2	Channel **3** type **5**	IW2
QW4		IW4

Table 3-5. One Word Format Examples

Sequential Channel

The *Sequential Channel Request + Reply* format is used to read and write to multiple channels one data type at a time. The first input or output word following the request and reply is of the requested channel number (CH) and data type (TP). The consecutive input and output words are sequential channels (CH +n) of the same data type.

For descriptions of the possible data types, refer to the Sonologic II Data Types section. Note a few data types are longer than one word and will require alternating with the *Next Element* format (FMT =3). Table 3-6 provides some examples.

	Output Words	Input Words
QW0	Request: RW = 0, FMT = 1, CH = 1, TP = 0	IW0 Reply
QW2		IW2 Channel **1** type **0**
QW4		IW4 Channel **2** type **0**
QW6		IW6 Channel **3** type **0**
		(up to Channel 16)

	Output Words	Input Words
QW0	Request: RW = 1, FMT = 1, CH = 3, TP = 5	IWO Reply
QW2	Channel **3** type **5**	IW2
QW4	Channel **4** type **5**	IW4
QW6	Channel **5** type **5** *(up to Channel 16)*	IW6

Table 3-6. Sequential Channel Format Examples

Next Element

The *Next Element Request + Reply* format is an extension of the *One Word* and the *Sequential Channel* format and is used to access the words of a multiple word data type.

When the first request for a new data type is placed with the One Word (FMT =0) or *Sequential Channel* (FMT =1) format, the first word of the data type is requested. If the format is then changed to *Next Element* (FMT =3), the second word of the data type is requested. When the format is changed back again (FMT =0 or =1), the third word of the data type is requested. By alternating the format (FMT) all of the words (elements) may be accessed.

Custom Data Page

The *Custom Data Page Request + Reply* format is used to read and write in the custom format specified by the parameterization. Similar to the *Custom* interface, the input and output words following the request and reply are defined by the channel number and data types specified in the custom parameterization. Regardless of the configured number of inputs or outputs the full 111 custom words may be utilized by breaking them into pages. The page word length is based on the number of configured inputs or outputs. Instead of directly specifying the data type, the requested data type (TP) sets the page number.

To read or write the first page of the custom words, set the requested type (TP =0) and the channel number (CH = 0).

The channel number (CH) of the request is an added offset to the channel number specified in the custom word parameterization. This provides the ability to index and control the channel number in the PLC logic. For example, if the custom word channel number in the parameterization are set to 0, then the channel of the data is the request channel (CH). See Table 3-7 for examples.

Parameter Name	Options	Example
Interface Method		Request + Reply
Starting Input Word	0-110	**0**
Starting Output Word	0-110	**50**
Custom Word 0 Channel	0-16	**1**
Custom Word 0 Data Type	0-255	**0**
Custom Word 1 Channel	0-16	**2**
Custom Word 1 Data Type	0-255	**0**
Custom Word 2 Channel	0-16	**3**
Custom Word 2 Data Type	0-255	**0**
Custom Word 3 Channel	0-16	**4**
Custom Word 3 Data Type	0-255	**4**
(words 4 to 49)		
Custom Word 50 Channel	0-16	**5**
Custom Word 50 Data Type	0-255	**3**
Custom Word 51 Channel	0-16	**6**
Custom Word 51 Data Type	0-255	**5**
Custom Word 52 Channel	0-16	**7**
Custom Word 52 Data Type	0-255	**3**
Custom Word 53 Channel	0-16	**8**
Custom Word 53 Data Type	0-255	**5**
(words 54 to 110)		

Reading Page 0 of Custom Inputs:

Output Words	Input Words
QW0 Request: RW = 0, FMT = 2, CH = 0, TP = 0	IW0 Reply
QW2	IW2 Channel **1** type **0**
QW4	IW4 Channel **2** type **0**

Reading Page 1 of Custom Inputs:

Output Words	Input Words
QW0 Request: RW = 0, FMT = 2, CH = 0, TP = 1	IW0 Reply
QW2	IW2 Channel **3** type **0**
QW4	IW4 Channel **4** type **4**

Writing to Page 0 of Custom Inputs:

Output Words	Input Words
QW0 Request: RW = 1, FMT = 2, CH = 0, TP = 0	IW0 Reply
QW2 Channel **5** type **3**	IW2
QW4 Channel **6** type **5**	IW4

Writing to Custom Outputs with a Channel Index:

Output Words	Input Words
QW0 Request: RW = 1, FMT = 2, CH = 3, TP = 0	IW0 Reply
QW2 Channel **8** type **3**	IW2
QW4 Channel **9** type **5**	IW4

Table 3-7. Custom Data Pages Interface Examples.

Sonologic II Data Types

This section lists the data types that may be communicated through the Sonologic II Profibus interface. The data type number is referenced in the interface to indicate the type of data to communicate. Some data types are read-only, and if written have no effect. A majority of them are read and write and are parameters stored in the nonvolatile memory of the Sonologic II. The input data range describes the range of values acceptable for each parameter. To obtain more information on any data type, refer to the *Sonologic II and Sonocell Installation and Operation Manual*.

0: Level Display (Level)
R 0 – 65535
Reported Level. Value based on Full Point, Span, and Mode. Units based on Standard, Special Form, and Special Display Units.

1: Echo Loss (EOL Status)
R 0 – 65535
Each bit of the word represents the echo loss status of the corresponding channel. Bit set equals channel in echo loss, either temporary or permanent. For faster update, select Channel 0 when reading this data type.

2: RawT (Raw Target)
R 0 – 65535 XXX.XX
Distance from the face of the transducer to the detected target.

3: Enable (Select channels)
R/W 0-65535
Each bit of the word represents a channel enable bit. If the bit is (0), the channel is not scanned.

10: ID (Display ID)
R/W 8 Words
Channel Display ID is 16 ASCII Characters.

11: BarS/Span (Bargraph span)
R/W
Bargraph span

20: Relay (Setpoint Status)
R 0 – 65535
Each bit of the word represents the relay status of the corresponding relay channel. Bit set equals relay active. For faster update, select Channel 0 when reading this data type.

21: Setpt/Set 1 (Setpoint 1)
R/W 4 Words
Defines assignment for setpoint 1.

Byte 0:	1 – 16	Channel Assigned
Byte 1:	0, 1,2	Force
	0 = No Force	
	1 = Force Low	
	2 = Force High	
Byte 2:	0, 1	Hi / Lo
Byte 3:	0, 1, 2	ELM (Echo Loss Mode)
Word 2:	0 – 65535	Value
Word 3:	0 – 65535	Dead

22: Setpt/Set 2 (Setpoint 2)
R/W 4 Words
Defines assignment for setpoint 2. See Setpt/Set 1

23: Setpt/Set 3 (Setpoint 3)
R/W 4 Words
Defines assignment for setpoint 3. See Setpt/Set 1

24: Setpt/Set 4 (Setpoint 4)
R/W 4 Words
Defines assignment for setpoint 4. See Setpt/Set 1

25: Setpt/Set 5 (Setpoint 5)
R/W 4 Words
Defines assignment for setpoint 5. See Setpt/Set 1

26: Setpt/Set 6 (Setpoint 6)
R/W 4 Words
Defines assignment for setpoint 6. See Setpt/Set 1

27: Setpt/Set 7 (Setpoint 7)
R/W 4 Words
Defines assignment for setpoint 7. See Setpt/Set 1

28: Setpt/Set 8 (Setpoint 8)
R/W 4 Words
Defines assignment for setpoint 8. See Setpt/Set 1

31: Iout/Set 1 (0-20mA Output 1)
R/W 7 Words
Defines assignment for 0-20mA Output 1.

Byte 0:	1 – 16	Channel Assigned
Byte 1:	0, 1, 2, 3	Force
	0 = No Force	
	1 = 0 mA	
	2 = 4 mA	
	3 = 20 mA	
Byte 2:	0, 1	Mode
Byte 3:	0, 1, 2	ELM (Echo Loss Mode)
Word 2:	0 – 65535	Set 0/4mA
Word 3:	0 – 65535	Set 20mA
Word 4:	0 – 65535	Cal 0mA
Word 5:	0 – 65535	Cal 4mA
Word 6:	0 – 65535	Cal 20mA

32: Iout/Set 2 (0-20mA Output 2)
R/W 7 Words
Defines assignment for 0-20mA Output 2. See Iout/Set 1

33: Iout/Set 3 (0-20mA Output 3)
R/W 7 Words
Defines assignment for 0-20mA Output 3. See Iout/Set 1

34: Iout/Set 4 (0-20mA Output 4)
R/W 7 Words
Defines assignment for 0-20mA Output 4. See Iout/Set 1

35: Iout/Set 5 (0-20mA Output 5)
R/W 7 Words
Defines assignment for 0-20mA Output 5. See Iout/Set 1

36: Iout/Set 6 (0-20mA Output 6)
R/W 7 Words
Defines assignment for 0-20mA Output 6. See Iout/Set 1

37: Iout/Set 7 (0-20mA Output 7)
R/W 7 Words
Defines assignment for 0-20mA Output 7. See Iout/Set 1

38: Iout/Set 8 (0-20mA Output 8)
R/W 7 Words
Defines assignment for 0-20mA Output 8. See Iout/Set 1

40: Baud (Baudrate)
R/W
RS-422 Serial Port Baud Rate.

50: Avg (Average)
R/W 1 – 255
Number of individual readings (from 1 to 255) that the Sonologic II averages for each display reading.

51:	**FulPt** (Full Point)	R/W -9999 – 9999 Distance from the face of the Sonocell to the top of the Span. Modifying **FulPt** allows you to change the point of reference for measurement. Units based on Standard or Special Display.
52:	**Span** (Span)	R/W 0 – 65535 Distance from the full point to the point where the vessel is considered empty. The Sonologic II displays material level changes within this range. Units based on Standard or Special Display.
53:	**Cal/Mode** (Mode)	R/W 0 – 1 0) Air Space, 1) Material. Air Space mode is defined as the amount of air space from the full point. Material mode is defined as the difference between air space and span.
54:	**StdD** (Standard Display)	R/W 0 – 12 Modifies the standard display unit. 0) ft, 1) 0.1 ft, 2) 0.01 ft, 3) in., 4) 0.1 in., 5) 0.01 in, 6) m, 7) 0.1m, 8) 0.01m, 9) 0.001m, 10) cm, 11) 0.1cm, 12) 0.01cm.
55:	**SpcD/Form** (Special Display Format)	R/W 0 – 6 Converts the standard unit of measure to a custom unit of measure, and sets up the number of digits to the left or right of the decimal point on the display: 0) XXXXX, 1) XXXX.X, 2) XXX.XX, 3) XX.XXX, 4) X.XXXX, 5) XXXXX00, 6) XXXXX0.
56:	**SpcD/Units** (Special Display Units)	R/W 2 Words Special display units is 3 ASCII characters.
57:	**SpcD/MaxV** (Special Display Max Value)	R/W 0 – 65535 Maximum value of the custom unit of measure. The Sonologic II equates this maximum value of the custom unit with 0-100% of the Span. Decimal based on Special Display Format.
60:	**Lin/Set** (Linearization Table)	R/W 64 Words Linearization Table: Word 0: 0 – 65535 Input point 1 Word 1: 0 – 65535 Output point 1 Word 62: 0 – 65535 Input point 32 Word 63: 0 – 65535 Output point 32 One input word and one output word per point. The first and last table entries must define the minimum value in/out. Additional points can be defined to insure accurate linearization over the span.
61:	**Lin/Default** (Linearization Default)	W 0 – 1 When Default = 1, defaults the linearization table based on the number of points in the linearization table.
62:	**Lin/Enab** (Linearization Enable)	R/W 0, 1 Turns linearization on and off.
63:	**Lin/Tnum** (Linearization Points)	R/W 2 – 32 Number of linearization points in the linearization table.
70:	**SPD/Mon** (Speed of Sound Monitor)	R 0 – 65535 XXXX.X Monitors the speed of sound, which is used by the Sonologic II in the calculation of level. The default value for speed of sound is based on the sound pulse traveling through air. At 68° F [20° C], the speed of sound is approximately 1127 ft/sec [344 m/sec].

71:	**SPD/Auto** (Speed of Sound Auto)	R/W	0 – 65535 Automatically adjusts the value for the speed of sound. Entering the current material level will cause the unit to recalculate the speed of sound to compensate for transmission medium changes. Units based on Standard Display and Special Display Format.
72:	**SPD/Man** (Speed of Sound Manual)	R/W	0 – 65535 XXXX.X % Correction factor, in percent, for the speed of sound. Allows compensation for transmission medium changes.
80:	**Freq/Trgt** (Target Frequency)	R/W	0 – 600 XX.X kHz Modifies the target frequency of the Sonocell set up for the current channel.
81:	**Freq/Mon** (Frequency Monitor)	R	0 – 600 XX.X kHz Monitors the frequency that the Sonocell for the current channel is actually transmitting and receiving.
82:	**Freq/Sel** (Frequency Selection)	R/W	0 – 4 Adjusts the Sonocell type for the current channel. The model number of the Sonocell corresponds to the Sonocell type: 0) SC43PT, 1) SC22PT, 2) SC-14PT, 3) SC-13PT, 4) Other.
83:	**#Cyc** (Number of Cycles)	R/W	0 – 255 Number of cycles in the transmission pulse.
84:	**Power** (Transmit Power)	R/W	0 – 1000 XXX.X % Amount of output transmission power in percentage that the Sonologic II utilizes. The default value is 100.0%.
90:	**TVG/HiLim** (High Limit)	R/W	0 – 20000 XXX.XX % High limit percentage for the TVG. This value is the highest the TVG will go in an effort to achieve an echo above the echo threshold (Echo). HiLim = LoLim = Fixed Gain.
91:	**TVG/LoLim** (Low Limit)	R/W	0 – 20000 XXX.XX % Low limit percentage for the TVG. This value is the lowest the TVG will go to get the echo below the peak threshold (Peak). HiLim = LoLim = Fixed Gain.
92:	**TVG/Mon** (Monitor)	R	0 – 20000 XXX.XX % Monitors the current TVG amplification.
93:	**TVG/Dly** (Delay)	R/W	0 – 200 XXX Shifts the portion of the TVG curve that is beyond the point where the blind space gain algorithm (BGN) is in effect.
94:	**TVG/Expo** (TVG Exponent)	R/W	0 – 255 X.XX TVG changes the R-squared gain curve.
95:	**TVG/Bgn** (Blind Space Gain)	R/W	0 – 100 XXX % Controls the gain in the “blind space” region of the Sonocell to help reduce ringing.
96:	**NearG** (Near Gain)	R/W	0 – 10000 XXX.XX % Near gain of the system.

97: MidG/Val (Midrange Value)	R/W	0 – 255	Midrange delay—the distance (in the selected length units) over which the TVG remains constant—adjusting the TVG curve in the middle distance range.
98: MidG/Pos (Midrange Position)	R/W	0 – 200	Distance (in the selected length units) from the face of the Sonocell to the beginning of the midrange delay Value.
100: Thrs/Echo (Echo Threshold)	R/W	0 – 1000 XXX.X %	Minimum amplitude the echo must achieve to be accepted as a valid echo
101: Thrs/Peak (Peak Threshold)	R/W	0 – 1000 XXX.X %	Peak threshold for return echoes.
102: Thrs/XTCF (Echo Threshold Comp)	R/W	0 – 10000 X.XXXX	Temperature compensation factor for the target echo threshold (Echo) to counter the effect of changes in transducer sensitivity with changes in temperature.
103: Thrs/MonET (Echo Threshold Monitor)	R	0 – 1000 XXX.X%	Monitors the current echo threshold, which includes the effect of the applied temperature compensation.
110: MinR/Set (Minimum Range Set)	R/W	0 – 65535	Distance for the minimum range of the Sonocell.
111: MinR/MDly (Minimum Range Delay)	R/W	0 – 12287	Number of counts to delay the minimum range by. If the Sonologic II detects instability in the return echo, it compensates by adding a slight delay (MDly) to the minimum range, extending it out past the unstable signal.
112: MinR/Mode (Minimum Range Mode)	R/W	0, 1	Mode has two submenus: 0) Auto, 1) Man. Selecting Auto enables the MDly parameter. Selecting Man disables the MDly parameter.
113: MinR/Mon (Minimum Range Monitor)	R	0 – 65535	Monitors the actual minimum range the system is using, which includes the effect of MDly (if Mode is Auto).
114: MaxR (Maximum Range)	R/W	0 – 65535	Maximum range of operation. The maximum range is the farthest distance from the face of the Sonocell where the Sono II stops recognizing the return signal.
115: EoL/Time (Echo Loss Timer)	R/W	0 – 65535 XXXXX seconds	Amount of time from when the echo loss is first detected to when it is reported on the display and I/O.
116: EoL/DsMode (Echo Loss Display Mode)	R/W	0, 1	Echo loss indication mode—0) Timed or 1) Tempry.

117: EndR (Echo Processing Term)	R/W	0, 1
	Increases the rate at which the Sonocell transmits signals for targets that are close to the Sonocell. 0) Target: If the Sonocell detects a target closer than the maximum range it sends out the next signal, rather than waiting until the time based on maximum range. 1) MaxRang: The Sonocell waits an amount of time based on the maximum range, before it transmits the next signal.	
118:DlyOff (Propagation Delay Offset)	R/W	5 Words
	Propagational delay for the electronic circuitry. Word 0: 0 – 65535 (43 kHz) Word 1: 0 – 65535 (22 kHz) Word 2: 0 – 65535 (14 kHz) Word 3: 0 – 65535 (13 kHz) Word 4: 0 – 65535 (Other)	
130: DSP/Qual (DSP Filter Qualify)	R/W	0 – 255
	Triggering number of successive signals above or below the median signal value, but within the Step window.	
131: DSP/Step (DSP Filter Step)	R/W	0 – 65535
	Window of equal height above and below the reference median.	
132: DSP/Enab (DSP Filter Enable)	R/W	0, 1
	Turns the filter function on and off.	
133: DSP/Fact (DSP Filter Factor)	R/W	0 – 100 XXX%
	DSPFact determines the magnitude of change from the old reference median to the new reference median.	
140: Noise/Mon (Noise Filter Monitor)	R	0 – 1000 XXX.X %
	Monitors the current noise level that may confuse the signal processor.	
141: Noise/MDevR (Filter Deviation Ratio)	R	0 – 1000 XXX.X
	Monitors the current deviation ratio. This number is calculated by dividing the listen deviation value (LDev) by the transmit deviation value.	
142: Noise/NLim (Noise Filter Limit)	R/W	0 – 1000 XXX.X %
	Noise threshold. Measured noise levels (NMon) that are above this threshold cause the noise algorithm to be switched on.	
143: Noise/SDevR (Sigma Deviation Ratio)	R/W	0 – 255 XX.X
	Deviation ratio threshold. Any measured deviation ratios (MDevR) larger than SDevR indicate a high confidence level that the mean transmit target value is the actual target.	
144: Noise/LDev (Filter Listen Deviation)	R	0 – 1000
	Monitors the listen deviation value.	
145: Noise/LAvg (Filter Listen Average)	R	0 – 1000
	Monitors the mean value of the listen deviation, and is displayed in the current engineering units.	
146: Noise/NTP (Filter TX's per Point)	R/W	1 – 16
	Number of transmission cycles per point when noise algorithm is activated.	

150: Win/Set (Window Size Set)	R/W	0 – 65535 Size of the window around the target. Only signals within the window are recognized as valid targets.
151: Win/Timer (Window Timer)	R/W	0 – 65535 XXXXX seconds Limit on timing if the target cannot be detected within the window.
155:MRG/Enab (Filling Noise Filter Enable)	R/W	0, 1 Turns MRG on (1) and off (0).
156: MRG/Win (Filling Noise Filter Window)	R/W	0 – 65535 Window size around the target.
157: MRG/GrpS (Filling Filter Group Size)	R/W	0 – 20 Number of transmit signals for the MRG analysis.
159: TPP (Transmission Per Point)	R/W	1 – 255 Number of transmission cycles per point.
160: Temp/FixT (Enable Fixed Temp)	R/W	0, 1 Enables the fixed temperature setting.
161: Temp/FixT (Fixed Temperature)	R/W	F: -4595 – 32748 XXXX.X deg F C: -2731 – 62804 XXXX.X deg C K: 0 – 65535 XXXX.X deg K Enter a fixed temperature. Units based on Temp/Scale.
162: Mon/Temp (Monitor Temperature)	R	0 – 10000 XXXX.X deg X Monitors the temperature (Temp). Units based on Temp/Scale.
163: Mon/ADC (Monitor ADC)	R	0 – 65535 Monitors the A to D counts (ADC).
164: Mon/MinT (Monitor Minimum Temp)	R	0 – 10000 XXXX.X deg X Monitors the minimum temperature (MinT) since the last reset.
165: Mon/MaxT (Monitor Maximum Temp)	R	0 – 10000 XXXX.X deg X Monitors the maximum temperature (MaxT) since the last reset.
166: Temp/Scale (Temperature Scale)	R/W	0, 1, 2 Temperature scale: 0) Celsius (°C), 1) Fahrenheit (°F), or 2) Kelvin (°K)—for entering a temperature (in FixT) and monitoring the temperature (in Mon).
180: TxDly (Transmission Delay)	R/W	0 – 255 XX.X seconds Delays the time between transducer firings. Same for all channels.
181: MTVG/Dstep (Decrease Step)	R/W	0 – 255 Adjusts the decrease in TVG percentage when in automatic TVG. This parameter is the same for all channels.
182: MTVG/DQual (Decrease Qualifier)	R/W	0 – 255 Number of qualifiers necessary to begin decreasing the TVG when in auto mode. This parameter is the same for all channels.

183: MTVG/Mode (Algorithm Mode)	R/W	1, 2, 3, 4	Algorithm selection: 1) First Echo, continuous adjustment of TVG to hold echo at peak setting. Starts at TVG LoLim at power on. 2) Largest Echo, continuous adjustment of TVG to hold largest echo at peak setting. Starts at TVG LoLim. 3) Similar to Mode 1. Adjusts TVG to hold first echo between Echo and Peak Threshold. Starts at TVG mid-point. 4) Similar to Mode 2. Adjusts TVG to hold largest echo between Echo and Peak Threshold. Starts at TVG mid-point.
200: Access/User (User Password)	R/W	0 – 9999	XXXX User Access Password.

Appendix A. Kistler-Morse Service and Warranty

Product Warranty

A complete, unabridged copy of our product warranty is available upon request from Kistler-Morse. A summary of the warranty, *subject to the terms and conditions listed fully in the warranty*, follows:

> Kistler-Morse warrants equipment of its own manufacture to be free from defects in material and workmanship for one year from date of shipment to original user. Kistler-Morse will replace or repair, at our option, any part found to be defective. Buyer must return any part claimed defective to Kistler-Morse, transportation prepaid with an Return Material Authorization (RMA).

Service

Kistler-Morse maintains a fully trained staff of field service personnel who are capable of providing you with complete product assistance. Our field service staff is based in Bothell, Washington USA (corporate headquarters); and Antwerp, Belgium (European office).

Phone Consultation

Kistler-Morse provides the following services by telephone, via our regular and toll free number (toll free in USA and Canada only), *at no charge*:

- Technical, application, and troubleshooting assistance
- Spare parts assistance
- Warranty (replacement) assistance

On-Site Consultation

Kistler-Morse's Field Service staff can provide additional services at your request. Contact Kistler-Morse at the closest office for rates and scheduling information for the following services:

- Technical, application, startup, and troubleshooting assistance on-site
- Training on-site or at our corporate office
- Service calls
- Equipment updates to our latest configuration

General descriptions of some of these standard services follow. Of course, if your service needs vary from those described, we are available to discuss them with you.

Installation, Startup Assistance, and On-Site Training

Notes

1. For vessels to be instrumented with Microcells, L-Cells, or Sonocells, the customer may contract to have Kistler-Morse install the sensors or transducers. For all other types of sensors and transducers, installation must be performed by the customer.

2. Field wiring, conduit installation, junction box mounting, and signal processor mounting must be performed by the customer. The AC power must be connected to the signal processor, but not energized, prior to Kistler-Morse beginning work.

All field wiring will be checked for errors. The system will be powered up and checked out for proper electrical operation. Calibration will be performed if possible. If it is not possible to calibrate, a pre-calibration will be performed. Recommendations for the optimum performance of the system will be provided.

On-site training will include simulation of the calibration process (if calibration could not be performed while Kistler-Morse is on site) and instruction covering operation and maintenance of the system.

Troubleshooting

Kistler-Morse will troubleshoot systems for mechanical, electrical, calibration, and wiring errors. Normal component repair and wiring errors will be corrected, including replacement of non-repairable printed circuit boards.

Service Calls

Kistler-Morse will perform on-site repair or replacement services.

Return Material Authorization

If a part needs to be sent to the factory for repair, contact Kistler-Morse's corporate office and ask for a Return Material Authorization (RMA) number. The RMA number identifies the part and the owner and must be included with the part when it is shipped to the factory.

Address and Telephone Numbers

Corporate Office

Kistler-Morse Corporation
19021 120th Avenue NE Suite 101
Bothell, WA 98011-9511 USA

Phone: 425-486-6600
Toll Free (U.S.A. and Canada):
800-426-9010
Fax: 425-402-1500
http://www.kistlermorse.com

European Office

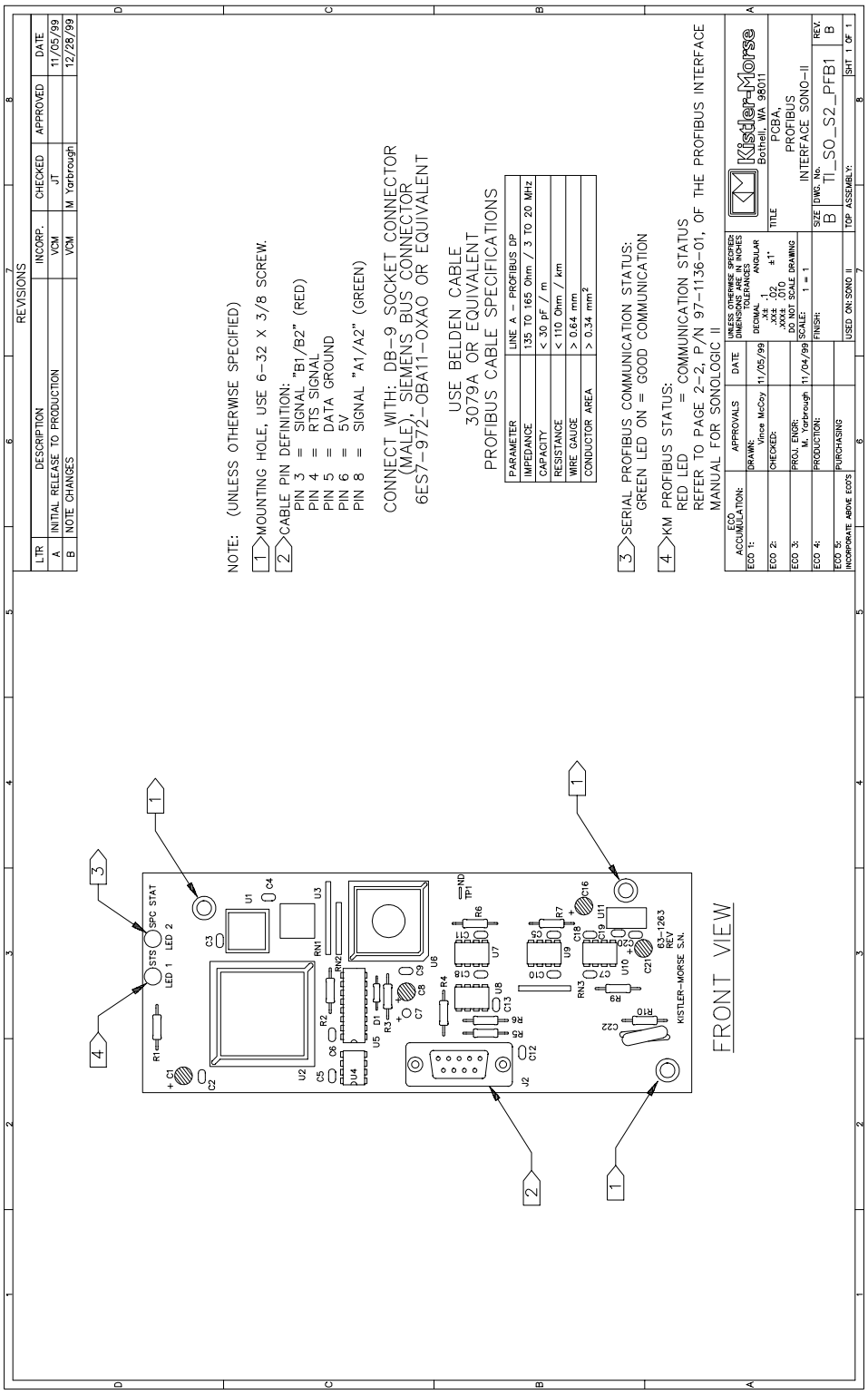
Kistler-Morse Corporation
Rucaplein 531
B-2610 Wilrijk-Belgium

Phone: 32.3.218.99 99
Fax: 32.3.230.78 76
Email: kistler.morse@skynet.be

Appendix B. Technical Drawings

This appendix contains the following technical drawing for the Profibus PCB card:

Drawing No.	**Drawing Title**
TI_SO_S2_PFB1	PCBA, Profibus Interface Sono-II


REVISIONS
LTR | DESCRIPTION | INCORP. | CHECKED | APPROVED | DATE
A | INITIAL RELEASE TO PRODUCTION | VCM | JT | | 11/05/99
B | NOTE CHANGES | VCM | M Yarbrough | | 12/28/99
NOTE: (UNLESS OTHERWISE SPECIFIED)
1 MOUNTING HOLE, USE 6-32 X 3/8 SCREW.
2 CABLE PIN DEFINITION:
PIN 3 = SIGNAL "B1/B2" (RED)
PIN 4 = RTS SIGNAL
PIN 5 = DATA GROUND
PIN 6 = 5V
PIN 8 = SIGNAL "A1/A2" (GREEN)
CONNECT WITH: DB-9 SOCKET CONNECTOR (MALE), SIEMENS BUS CONNECTOR 6ES7-972-OBA11-OXAO OR EQUIVALENT
USE BELDEN CABLE 3079A OR EQUIVALENT PROFIBUS CABLE SPECIFICATIONS
PARAMETER | LINE A - PROFIBUS DP
IMPEDANCE | 135 TO 165 Ohm / 3 TO 20 MHz
CAPACITY | < 30 pF / m
RESISTANCE | < 110 Ohm / km
WIRE GAUGE | > 0.64 mm
CONDUCTOR AREA | > 0.34 mm²
3 SERIAL PROFIBUS COMMUNICATION STATUS:
GREEN LED ON = GOOD COMMUNICATION
4 KM PROFIBUS STATUS:
RED LED = COMMUNICATION STATUS
REFER TO PAGE 2-2, P/N 97-1136-01, OF THE PROFIBUS INTERFACE MANUAL FOR SONOLOGIC II
ECO ACCUMULATION:
ECO 1:
ECO 2:
ECO 3:
ECO 4:
ECO 5:
INCORPORATE ABOVE ECO'S
APPROVALS | DATE
DRAWN: Vince McCoy | 11/05/99
CHECKED:
PROJ. ENGR: M. Yarbrough | 11/04/99
PRODUCTION:
PURCHASING
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
TOLERANCES: DECIMAL ANGULAR
X± .1 ±1°
XX± .010
XXX± .005
DO NOT SCALE DRAWING
SCALE: 1 = 1
FINISH:
USED ON: SONO II
Kistler-Morse
Bothell, WA 98011
TITLE: PCBA, PROFIBUS INTERFACE SONO-II
SIZE: B | DWG. No.: T1_SO_S2_PFB1 | REV.: B
TOP ASSEMBLY:
SHT 1 OF 1
FRONT VIEW
SPC STAT
LED 1 LED 2
STS
KISTLER-MORSE S.N.
63-1283
REV