

# **86180003**

## **Scoreboard**

### **User's Guide**

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**METTLER TOLEDO**

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**Declaration of conformity**  
Konformitätserklärung  
Déclaration de conformité  
Declaración de Conformidad  
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Dichiarazione di conformità

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EN50081-1:1992                Immunity

EN50082-2:1994, A           Emissions / Funkstörungen

73/23/EU Low Voltage / Niederspannung / basse tension\*

EN61010                        el. Safety / el. Sicherheit / sécurité el.

\* When installed with an approved and compatible external power supply

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Darrell Flocken, Manager - Weights & Measures  
Office of Weights and Measures  
Worthington, Ohio USA  
**February, 1999**

according to EN45014

## **INTRODUCTION**

This publication is provided solely as a guide for individuals who have received Technical Training in servicing the METTLER TOLEDO product.

Information about METTLER TOLEDO Technical Training can be obtained by writing, calling, or faxing:

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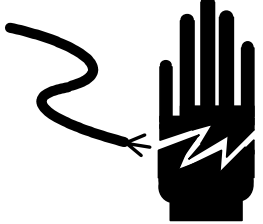

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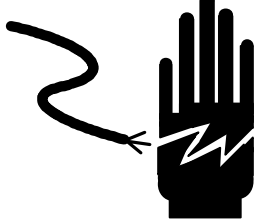

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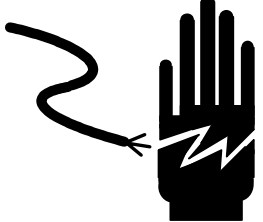

READ this manual BEFORE operating or servicing this equipment.

	 <b>WARNING</b>
	<b>PERMIT ONLY QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS, AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.</b>

FOLLOW these instructions carefully.

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	<b>FOR CONTINUED PROTECTION AGAINST SHOCK HAZARD, CONNECT TO PROPERLY GROUNDED OUTLET ONLY. DO NOT REMOVE THE GROUND PRONG.</b>



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DO NOT allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this equipment.

 <b>CAUTION</b>	
<b>BEFORE CONNECTING/DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT, ALWAYS REMOVE POWER AND WAIT AT LEAST 30 SECONDS. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY HARM OR DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT.</b>	

ALWAYS DISCONNECT this equipment from the power source before cleaning or performing maintenance.

	 <b>CAUTION</b>
	<b>OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.</b>

CALL METTLER TOLEDO for parts, information, and service.

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# 1

## Introduction

The METTLER TOLEDO 86180003 scoreboard is a highly visible weight display for use with vehicle scales and other industrial weighing applications. It displays up to six digits plus the weight unit (lb or kg). The 100-mm (4-inch) digits can be read easily from 30 m (100 feet) away. The scoreboard is designed to operate with METTLER TOLEDO digital indicators that are equipped with continuous serial data output. It can be installed at a location other than where the scale indicator is set up, and it is suitable for use outdoors or in industrial environments.

This manual explains how to install and use a Model 86180003 scoreboard.

## Specifications

Enclosure:	1.5-mm stainless steel
Front Panel:	4-mm glass or polycarbonate
Environmental Protection:	IP65 (NEMA 4X)
Weight:	5.5 kg (12.1 lb)
Cable Glands:	PG11, maximum 10-mm cable diameter
Connections:	Maximum 10-mm cable for power and data lines Power: AWG24-AWG14 (0.2-1.5 mm <sup>2</sup> ) Data Line: AWG25-AWG20 (0.14-0.5 mm <sup>2</sup> )
Power Input:	Universal input 100 to 240 VAC, 50/60 Hz max. 12W
Operating Temperature:	-35°C to +45°C (-31°F to +113°F)
Storage Temperature:	-40°C to +70°C (-40°F to +158°F)
<b>Serial Interface Card</b>	
Communication Speed:	300 to 38,400 baud
Data Bits:	7 or 8*
Parity:	None, even, or odd*
Standard Electrical Interfaces:	20 mA current loop, passive input and output fully isolated RS-232 input fully isolated RS-422 input non-isolated RS-485 input or output non-isolated

\*NOTE: Do not use a configuration of 7 data bits and no parity. The scoreboard does not support that configuration.



## New Features

The following features have been added to the scoreboard for the release of Model 86180003:

- Built-in universal power supply: 24VDC/0.4A (100-240VAC/DC, 50/60 Hz). It includes an over-temp sensor that reduces the output voltage to 13V, cutting the backlight but not the electronics and display.
- Designator display to auto detect lb/kg/t/g and G(ross)/N(et)/T(are). The scoreboard supports Toledo Continuous, 8617, and 8624 protocols, plus some others with designator information.
- Automatic baud rate detection and protocol detection for most protocols.
- Dip switches for setting the scoreboard's address. No remote control is needed for METTLER TOLEDO protocols.
- Improved surge voltage protection: Inputs are now protected by PTC resistors and Tranzorbs, plus comgap for low voltage supply and current loop input.
- Access to controller and power supply, making it possible to replace them in the field.
- Test capabilities: (1) LEDs indicate when power is on and data is being received, (2) Button on controller PCB displays raw data when scoreboard is in TEST mode. Displaying raw data helps establish what data is received and can be used for telephone support or to correct baud rate and sensible data.
- PC-definable simple protocol allows field programming for operation on equipment that is old or otherwise unsupported.
- Remote control cannot be used to select non-installed hardware.
- Approvals: UL 508, UL 50, and NEMA 4X.



# 2

## Installation

### General



### CAUTION

**THE SCOREBOARD AND ITS ASSOCIATED EQUIPMENT MUST BE INSTALLED, ADJUSTED, AND MAINTAINED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL EQUIPMENT IN THE SYSTEM AND WITH THE POTENTIAL HAZARDS INVOLVED. FAILURE TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.**

Install the scoreboard in a location that permits access for maintenance and inspection. Locate the scoreboard so that dirt, excessive water, and other harmful materials will not fall on or around the enclosure. Read this manual carefully. If this is your first time installing a scoreboard, we recommend connecting the equipment on a workbench before installing it in the field.

You will need the following tools/materials to install the 8618 scoreboard:

- TORX T20 screwdriver
- 21-mm wrench for cord-grip caps
- Power supply cable with properly grounded plug (20-gauge copper wire, twisted pair, shielded cable)
- Communication cable (20-gauge copper wire, twisted pair, shielded cable)
- Three 6-mm (1/4-inch) screws for mounting scoreboard
- Screwdriver for mounting scoreboard

### Protocol Selection

If you are connecting the scoreboard to a scale terminal with Toledo Continuous Protocol, you can use the scoreboard's default operational parameters. If you are connecting to any other instrument, you might need to change the parameters. Please refer to Chapter 4 (Setting Operational Parameters) and Chapter 5 (Protocol Selection). Note the standard setup displayed when you power-up the scoreboard:

<b>XX.XXN</b>	Version Number
<b>A:00</b>	Address of the Display 00
<b>P:Auto</b>	Automatic Protocol Selected (Factory Default)
<b>C:4800</b>	Baud Rate 4800 (If auto baud found 4800 baud)
<b>P:21</b>	(If auto protocol found Toledo Continuous message format)

NOTE: After the P:Auto message is displayed, the scoreboard might flash CA while waiting for input.

If there is any deviation, you will need to edit the operational parameters.

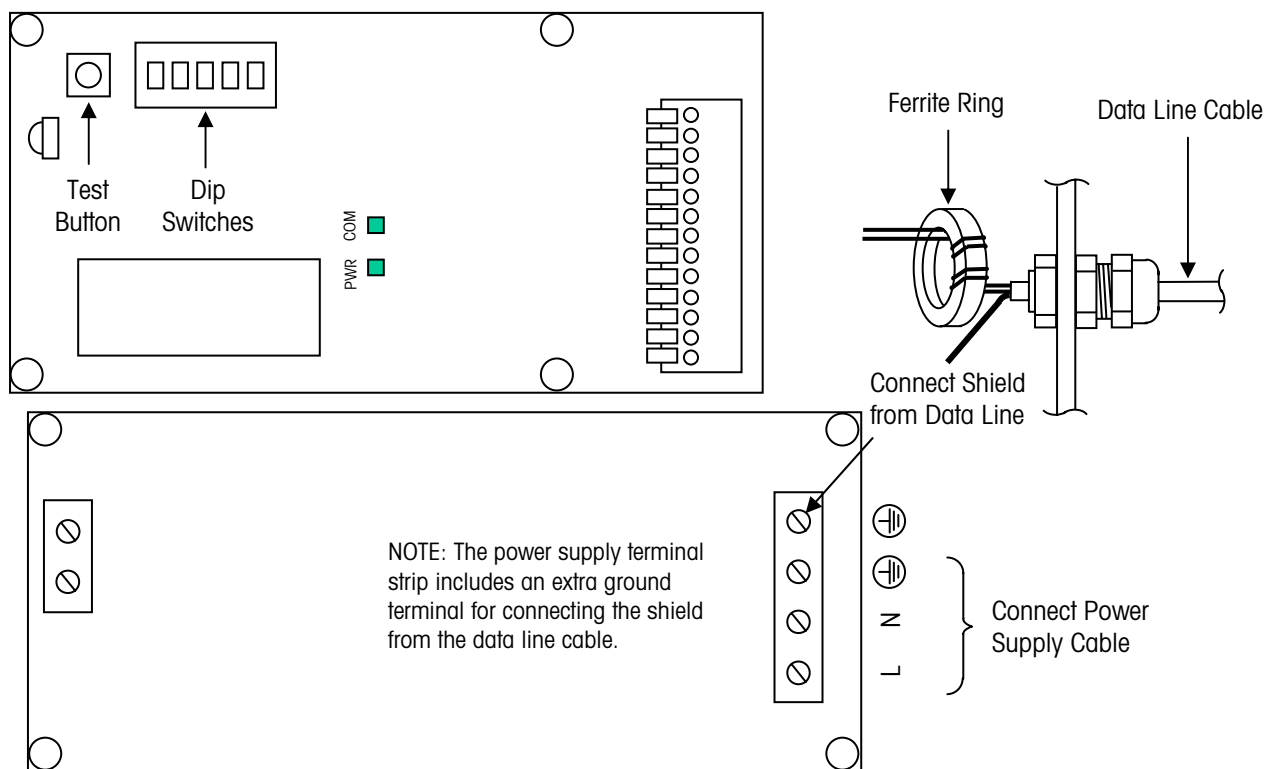
## Power Supply Connection



The scoreboard has a built-in universal input power supply. A properly grounded power supply of 230 or 115 Volts AC is required. You will need to provide a power supply cable (20-gauge copper wire, twisted pair, shielded cable) and connect it to the scoreboard's junction box. NOTE: A main disconnect is required and shall be provided by the installer.

NOTE: Cord grips will accept cables with outer diameters of 5 to 10 mm. For diameters larger than 8 mm, remove the nitrile tube inside the cord grip.

1. Make sure power is off.
2. Remove the removable cover on the back of the scoreboard (see Chapter 7).
3. Loosen the cord-grip cap next to the power supply terminal strip inside the cover, and insert the end of the power supply cable through the opening in the cap.
4. Wire the cable to the Line, Neutral, and Ground terminals as shown in Figure 2-1.

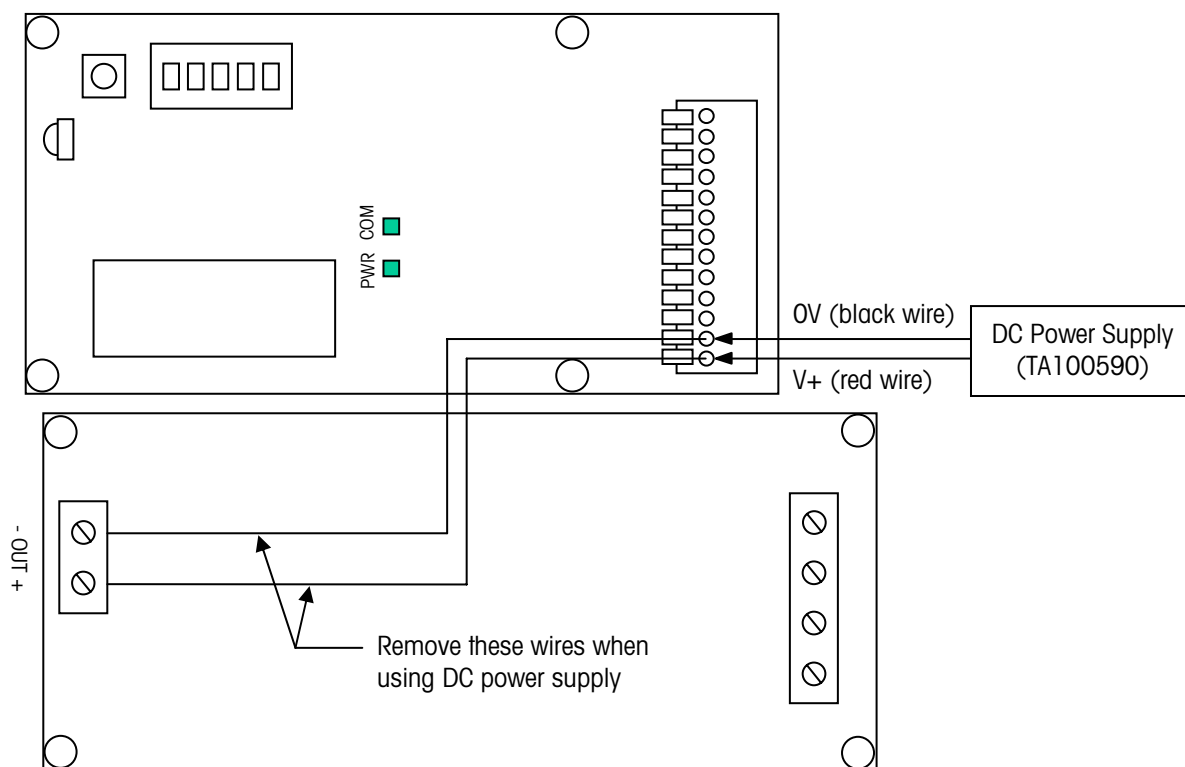


**Figure 2-1: Power Supply Cable Wiring**

## DC Power Supply Option

The scoreboard can be run on a DC power supply instead of the internal power supply. To do that, you will need to purchase an external 24V power supply (part number TA100590) and connect it to the scoreboard as shown in Figure 2-2. This external power supply can power up to four scoreboards. Using a DC power supply will allow you to route both the power line and the data line through a single conduit without any interference.

1. Remove the cover on the back of the scoreboard (see Chapter 7).
2. Remove the wires that connect the internal power supply to the controller PCB.
3. Connect the two wires from the external power supply to the controller PCB.



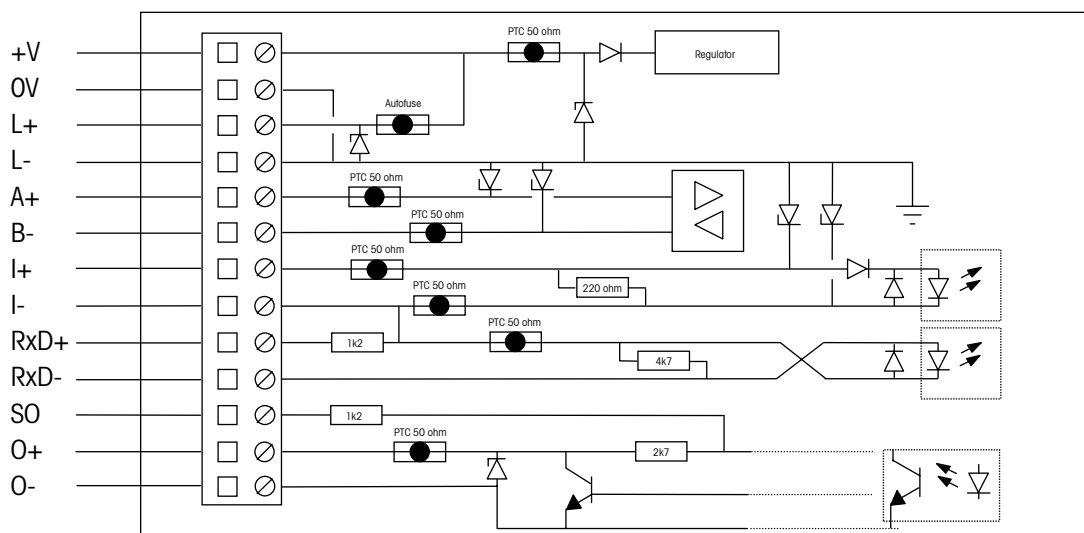
**Figure 2-2: DC Power Supply Cable Wiring**

## Communication Connections

Wire the scoreboard to the scale terminal, using a 20 mA current loop passive, RS-232, or RS-485 interface. You will need to remove the cover on the back of the scoreboard (see Chapter 7) to connect wiring to the scoreboard's controller PCB. A description of the conductors terminated in the scoreboard is shown below.

Terminal	Signal Name	Signal Description
O-	GND RS	CL 20mA output - (RS-232 GND for RS-232 answer-back)
O+	RxD	CL 20mA output + (RS-232 output for RS-232 answer-back)
SO	+12V	+V source (12 VDC for RS-232 answer-back)
RxD-	GND RS	RS-232 ground (input)
RxD+	TxD	RS-232 RxD (input)
I-	Tx-	CL 20mA input -
I+	Tx+	CL 20mA input +
B-	RS-485B	RS-485B / RS-422- (input)
A+	RS-485A	RS-485A / RS-422+ (input)
L-	-	Internal connection only (LED- output)
L+	-	Internal connection only (LED+ output)
OV	OV	OV power return (from internal power supply)
+V	+24VDC	Power input (from internal power supply)

The circuit diagram (Figure 2-3) shows some detail that is useful when connecting some communication lines. For example, the link from RxD+ to I- is normally used only to limit current flow in daisy-chained current loops based on the 24V power supply.



**Figure 2-3: Simplified Scoreboard Interface Circuit Diagram**



## 20 mA CL Connection

The maximum cable length for a 20 mA CL connection is 1,000 feet (304.8 meters). Wire the scale terminal to the scoreboard's controller PCB as shown in Figure 2-4.

NOTE: Connect the shield wire from the data line cable to the ground terminal as shown in Figure 2-1. At the scale terminal, connect the shield wire to the same ground point as the outer drain wire from the home run cable (see drawing TC100460).

NOTE: Wrap the data line cable around a ferrite ring as shown in Figure 2-1.

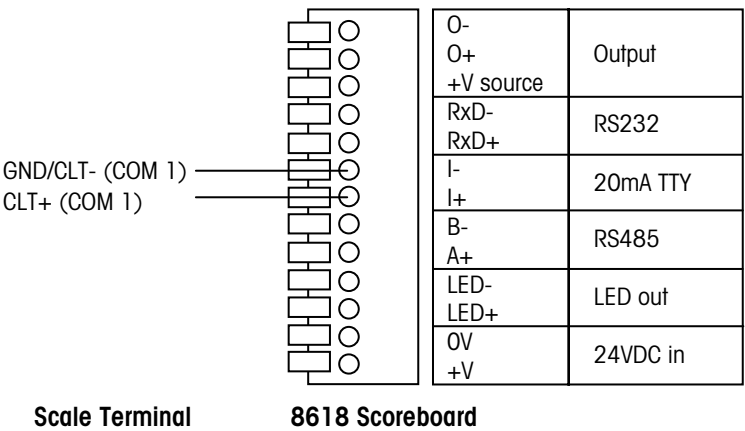


Figure 2-4: 20 mA CL Wiring

## RS-232 Connection

The maximum cable length for an RS-232 connection is 50 feet (15.24 meters). Wire the scale terminal to the scoreboard's controller PCB as shown in Figure 2-5.

NOTE: Connect the shield wire from the data line cable to the ground terminal as shown in Figure 2-1. At the scale terminal, connect the shield wire to the same ground point as the outer drain wire from the home run cable (see drawing TC100460).

NOTE: Wrap the data line cable around a ferrite ring as shown in Figure 2-1.

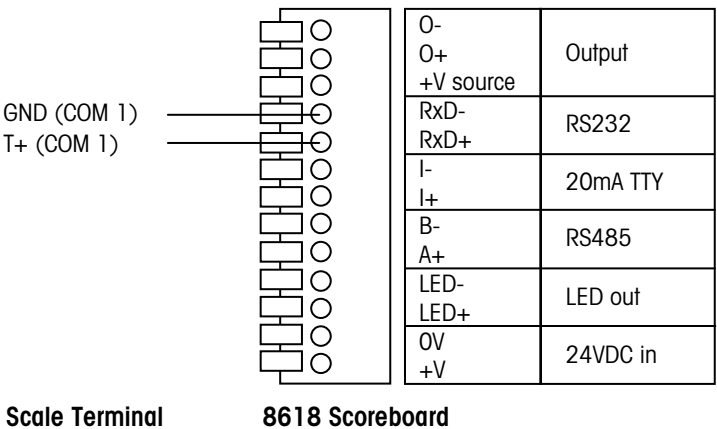
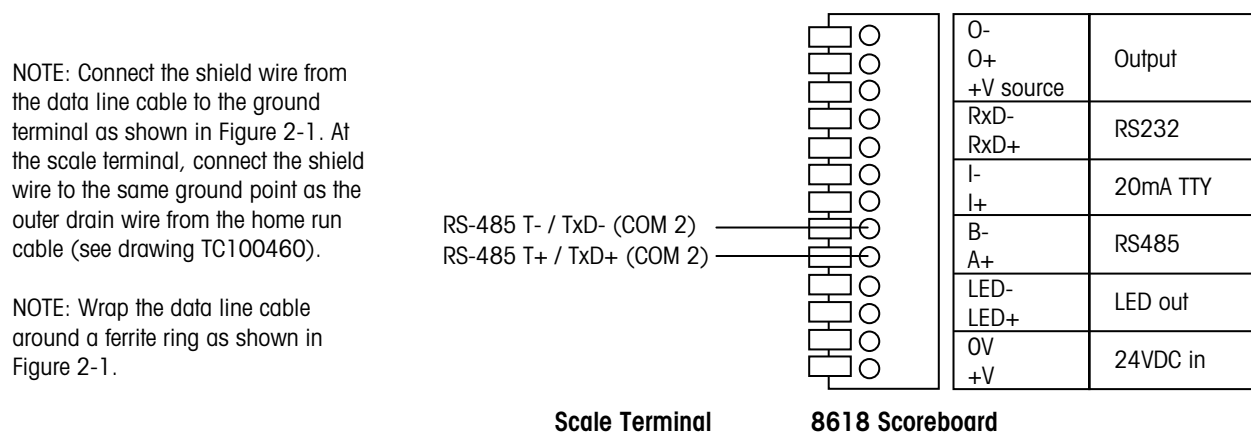


Figure 2-5: RS-232 Wiring

## RS-485 Connection

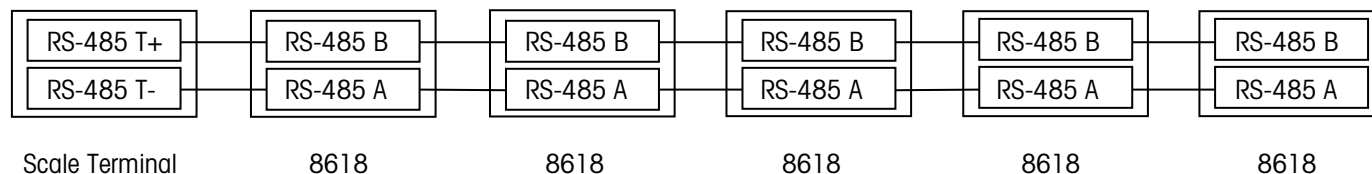
The maximum cable length for an RS-485 connection is 2,000 feet (609.6 meters). Wire the scale terminal to the scoreboard's controller PCB as shown in Figure 2-6.



### Figure 2-6: RS-485 Wiring

### Multi-Drop Arrangement

RS-485 allows you to connect as many as five scoreboards in a multi-drop arrangement so that each scoreboard displays a different weight reading. To do that, you must set the operational parameters for P:22 or P:23 protocol and assign a separate address for each scoreboard. Wire the scale terminal to the first scoreboard, and wire each additional scoreboard to the one preceding it (as shown in Figure 2-7).



### Figure 2-7: RS-485 Multi-Drop Wiring

- P:22 corresponds to Multi-Continuous 2 on the JAGXTREME terminal. P:23 corresponds to Multi-Continuous 1 on the JAGXTREME terminal

## 20 mA Echo Output

You can use the 20 mA output circuit for daisy-chaining scoreboards together. In this type of arrangement, each scoreboard transmits data to the next one in the series so that all scoreboards display the same weight reading. Since a scoreboard does not know how the data enters the processor, you can input data to the first display in any format (RS-232, RS-485, RS-422, 20 mA CL) and redistribute it from the output (Echo) port using the current loop connection. Delay on the line is one byte-time per connected display.

Wire the scale terminal to the first scoreboard, using a 20 mA CL, RS-232, or RS-485 connection (see Figures 2-4, 2-5, and 2-6). Then wire each scoreboard to the next one in the series as shown in Figure 2-8.

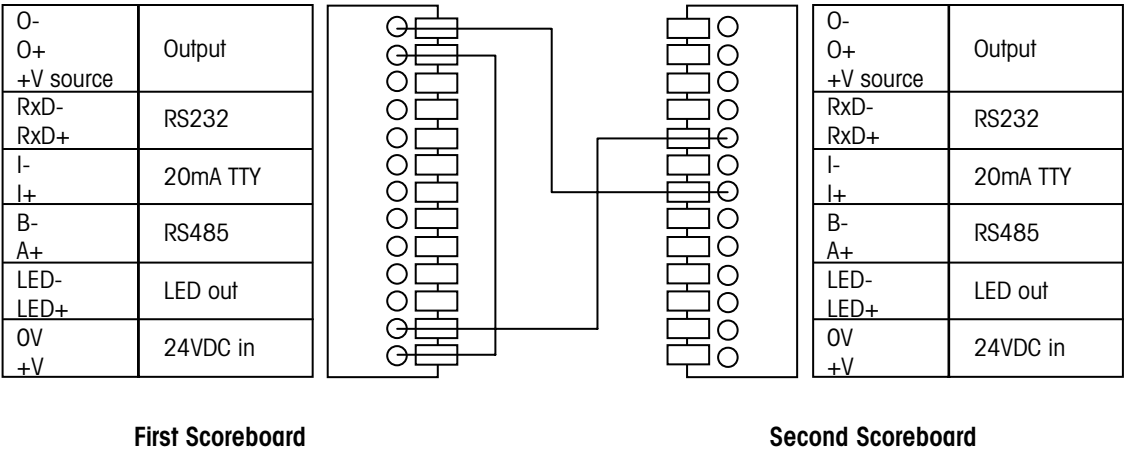


Figure 2-8: 20 mA Echo Wiring

## Mounting

The universal mounting bracket that is supplied with the scoreboard is suitable for ceiling, roof, or wall mounting. Use three 6-mm or 1/4-inch screws to attach the bracket to a rigid surface. Do not mount the scoreboard on a vibrating structure such as machinery. Evaluate the expected torque applied by wind forces to ensure that the scoreboard is mounted safely. The bracket can be attached to the scoreboard with stainless steel bolts M6 x 20 (1.0 mm), using a torque of approximately 10 N·m.



# 3

## Scoreboard Behavior

### Power-up Sequence

8888888

08.06A

A:00

P:AUTO

CA

C:9600

PF

PA

. . . . .

This section describes the power-up sequence for the scoreboard:

1. When power is supplied to the scoreboard, all segments on the display will be activated for a few seconds and then deactivated briefly. During this part of the sequence, you will be able to tell if any of the display segments have failed.
2. The software version number (for example 08.06A) will be displayed. Note the version number and communicate it to your supplier if the scoreboard fails.
3. The scoreboard address will be displayed (the default is A:00). If another address setting is used, a scoreboard that is in automatic protocol mode will recognize only the protocol/message formats for the specific address setting.
4. If the scoreboard is in automatic mode (this is the default), P:AUTO will be displayed briefly while the scoreboard searches for a suitable protocol setting. In manual mode, the scoreboard will display the predefined protocol setting (for example P:21). The mode can be changed using an internal dipswitch.
5. When auto-baud rate is enabled, the scoreboard will display CA while trying to determine the communication speed. CA will be displayed until the number of bits has been detected. If no data is found, CA will continue to be displayed.
6. The baud rate will be displayed (for example C:9600). You can select a baud rate manually by using the remote control to set the operational parameters.
7. When automatic protocol detection is selected, the scoreboard will display PF while it tries to find the data and then PA when it analyzes the data. These messages should appear only briefly. If no valid protocol is found, the scoreboard will loop through the initial sequence repeatedly.
8. When the power-up sequence is completed, the display will go blank with all decimal points activated. This indicates that the scoreboard awaits incoming data.
9. Communication lines are checked continuously to make sure they are operating correctly. If automatic baud rate detection is active, the parity bit and framing errors will be checked. When a large percentage of the characters received fail these tests, the Framing Error ("FE") message will be displayed and a new analysis performed.

To store parameters that were automatically detected during power-up, set the AUTO switch to OFF (manual mode) with the scoreboard's power on. After switching to manual mode, check the parameters by recycling power to the scoreboard.

NOTE: Automatic mode is intended to handle continuous data streams (which send a new message faster than once per 5 seconds). If your equipment does not send a continuous data stream, you might need to use the scoreboard in manual mode.

## Time-out

There are two time-outs used with the scoreboard: long and short.

- The long time-out fully resets the scoreboard whenever there has been no communication activity for approximately 4 minutes. The time-out period is normally reset for each valid message received.
- The short time-out blanks the screen to indicate that there has been no activity for 6-9 seconds. In response to a short time-out, the display goes blank and the protocol is initiated according to the parameter settings.

Both types of time-out are enabled for all advanced protocols (P:21, 22, 23). All protocols have the short time-out enabled as a fixed parameter and cannot be effectively changed. Only protocol P:20 can have the short time-out disabled (by using the remote control). P:20 protocol does not use the long time-out.

# 4

## Setting Operational Parameters

### Operational Parameters

NOTE: Some parameters have no operational effect on the behavior of a particular protocol, **while others can disable proper operation**. One such parameter is the SYSTEM/ADDRESS, which should be set to 00 when not in use. Any other value will make the display reject all messages except when the address header matches the programmed display address.

If you need to change the scoreboard's default parameters, use an optional Infrared Remote Control (TA000138). All parameters are stored in an EEPROM located inside the scoreboard's removable back cover. The parameters are listed in Table 4-1.

TEST		Enter a sequence to fetch and display raw data.
LINE	BAUD	Set the baud rate.
	DATA	Set the number of data bits.
	PARITY	Set the parity.
PROTOCOL		Set the protocol number.
SYSTEM	ADDRESS	Set address associated with the display.****
	DP SET*	Set fixed decimal point (not in use).
	DIGITS*	Set number of digits on display.
	SUP 0**	Set suppression of leading 0's on/off.
	SUP B**	Set suppression of leading blanks on/off.
	TIMEOUT**	Set short time-out on/off (6 seconds).
	ECHO***	Set communication echo function on/off.
	STARTC*	Set start-of-message byte ASCII value.
	STOPC*	Set end-of-message byte ASCII value.
	TSUPRES*	Set text suppression on/off.
	IGNORE*	Not available.
	NET*	Indicate net value on/off.
PULSE	RESET*	Set the pulse counter reset (enter number).
	PER COUNT*	Set the counting rate per pulse (enter number).
	UP/DOWN*	Set counting to up/down.

**Table 4-1: Operational Parameters Menu**

\*Do not use.

\*\*Applies only to P:20.

\*\*\*Echo always defaults to ON for P21, P22, P23, and P24, disabling the OFF selection.

\*\*\*\*Address assigned by setting dip switches has preference.

## Using the Remote Control

The remote control uses an infrared signal to program the scoreboard. Effective range of operation for the remote control is 8 inches. For software version 5.10 or later, the programming mode is disabled during normal operation. To enable it, you will need to disconnect the data line before using the remote control. You will also need to enter Manual mode by setting the AUTO dip switch to the OFF position.

1. Remove the cover on the back of the scoreboard (see Chapter 7).
2. To set parameters, point the remote control at the receiver on the scoreboard's controller PCB (see Figure 4-1). Press the remote control's «OPEN» button several times until the display responds with **Code0**.
3. Press the programmed 4-digit code (usually 0000) to open the parameters menu.
4. Use the arrow buttons to traverse through the menu and the «YES» button to select an option. The «NO» button will return you to the previous menu item or end the set-up procedure.

When pressing «YES» to make a selection, the currently active value will be displayed. Use the arrow buttons to scroll through the other possible values or type the required parameter number. Press the «YES» button to accept the new choice. There is not a 'Cancel' button, so please program with care. All new parameters take effect immediately after normal operation is resumed.

5. To exit the programming mode, press the «NO» button repeatedly until **End** and **Err.11** are displayed. The system will automatically restart.

### Notes on Infrared Remote Control Operation

Pressing the OPEN button while holding down the SHIFT button will force the program to "END" and automatically restart.

When using the remote control, be sure to protect other nearby scoreboards from the infrared signal by shielding the units or removing power from them.

The infrared receiver located on the scoreboard's controller PCB might be sensitive to certain frequencies emitted from artificial light sources. If the display is operated with the control board exposed to light sources, the following symptoms might occur: intermittent error code and intermittent restart.

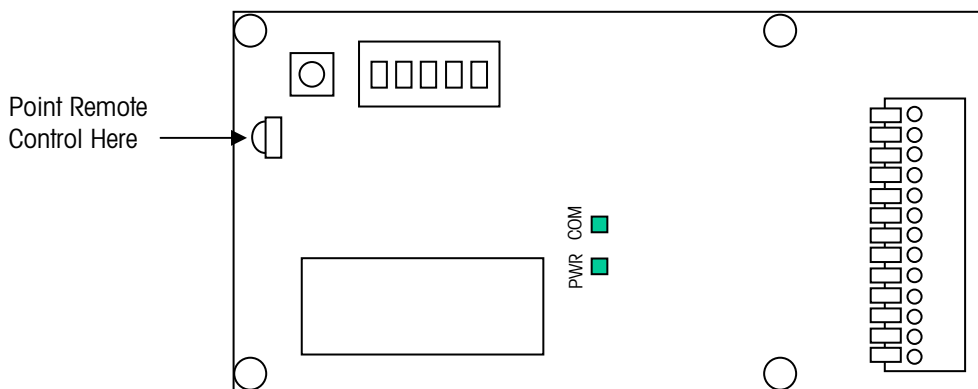


Figure 4-1: Infrared Receiver on Controller PCB



## Setting the Address

The factory default address setting for the scoreboard is 0. For some installations, you will need to change the address setting, for example, when you connect several scoreboards in a multi-drop arrangement. The dip switches on the scoreboard's controller PCB can be used to set the address (see Figure 4-2).

Use switches 2, 3, 4, and 5 to set the scoreboard's address. A value is assigned to each switch (switch 5 = 1, switch 4 = 2, switch 3 = 4, and switch 2 = 8). Table 4-2 shows how to set the switches for addresses 0 to 6. Switch 1 (AUTO) is used to turn the Automatic Protocol Mode on and off. If AUTO mode is on, the scoreboard will determine communication and protocol selections at power-up. Switching the AUTO mode off while the power is on will save the current setup and force the scoreboard to use the current baud rate and protocol selection.

Pressing the TEST push button allows you to enter a visual communication text mode (see Chapter 6 for more information).

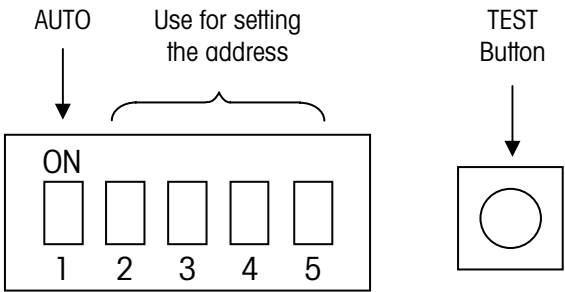


Figure 4-2: Dip Switches

Address	Switch 5	Switch 4	Switch 3	Switch 2
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF

Table 4-2: Dip Switch Settings



# 5

## Protocol Selection

### Protocol Selections

Protocols are provided to support all widely used METTLER TOLEDO instruments and related systems. Select the protocol that matches the scale terminal or other instrument connected to the scoreboard (refer to Table 5-1).

Protocol	Instrument	Description
P:20	Computer	Simple protocol – Receives ASCII text data from a computer
P:21	MT Continuous Data	Default setting, no address (A:00)
P:22	MT 8624 Multi-drop format	Addressed (A:01 to 05)
P:23	MT 8617 Multi-drop format	Addressed (A:01 to 05)
P:24	MT ID Series	No address (A:00)

**Table 5-1: Protocols for the 86180003 Scoreboard**

### Protocol P:20

Protocol P:20 sets the scoreboard to receive a simple ASCII string.

The scoreboard has six digits and can display a maximum of six characters from a host device. The data received is filtered so that only specific data will be displayed. The valid data are the ASCII characters: <0>, <1>, <2>, <3>, <4>, <5>, <6>, <7>, <8>, <9>, <-> minus sign, <.> decimal point, and <,> comma. No other ASCII characters will be displayed. Any display characters transmitted before the minus sign will be ignored. One decimal point or comma may be transmitted between any two numeric characters. So you could display a date using a decimal point delimiter, for example, <08.14.02>. A minus sign is displayed left justified and text is displayed right justified. The comma and decimal point both turn on the same element on the display.

The data format is <STX>DDDDDD<CR>, where D is a numeric ASCII character (0 to 9). When the minus sign is used, there is a maximum of 5 numeric ASCII characters. To blank out the scoreboard in the P:20 protocol, omit data characters in the transmit string: <STX><CR>.

**TSUPRES** option (this is always enabled, so it is not really optional)

Text suppression (filtering): All invalid text characters are discarded; however, valid text received after invalid text will overwrite the receive buffer.

Examples:

Data	Display
<STX>12QW<CR>	12
<STX>34AS56<CR>	56
<STX>ASDF<CR>	Blanks Display (same as <STX><CR>)

**SUP 0** (zero) option

**SUP B** (blank) option

Suppress leading zeros and leading blanks (spaces) setup features apply only to protocol P:20. If SUP 0 is set to OFF, then leading zeros will be displayed. It does not matter whether SUP B is set to ON or OFF, since the space character is an invalid character and will be discarded.

**TIMEOUT** option

When TIMEOUT is set to OFF, the scoreboard will continue to display the current message until new data is received. When it is set to ON, the scoreboard will time out and report [ , , , , , ] waiting for data error message. The time-out period is six seconds.

### Protocol P:20 with Addressing Feature

The addressing command must reside immediately following the START OF PROTOCOL byte, and the message to be displayed must reside in the same protocol body (prior to the END OF PROTOCOL byte). All addressed displays will be deselected after a message is received, so a new addressing command must be received for each message sent.

Protocol for addressed operation will be the STX-CR delimited string, where:

START OF PROTOCOL = <STX>

END OF PROTOCOL = <CR>

The address command is <SOH><address high><address low><STX>. Address high and low are ASCII characters representing a hex number. For example, an address of ASCII 44 (high = 4, low = 4) represents the hex number 44. Allow a 50-ms delay after each message to an addressed display.

Example transmission for an addressed scoreboard (address is 01 in scoreboard):

<STX><SOH>01<STX>1234.56<CR>

The scoreboard will display the message "1234.56"

All addressed scoreboards will respond to data strings sent with an address of 00. This is useful for occasions where multiple displays should be blanked or tested. Displays with an address of 00 will interpret and display all messages.

## Standard Protocol

A standard protocol is defined to allow you to interface the scoreboard quickly to any programmable equipment. This protocol supports numeric values only; the scoreboard will disregard text.

<STX>data<CR> will display data right-adjusted. A minus sign (hyphen) and decimal points will be displayed if present in the data string.

To address the scoreboard, set the dip switches to an address other than 0. The scoreboard will receive messages only when the address field is 00 (broadcast) or matches the address programmed by the dip switches (01 to 0F). Note that scoreboards that are not addressed (dip switches set to 0) will display all messages.

<STX><SOH>AA<STX>data<CR>

Note that the address field AA could range from 00 to FF, but the scoreboard is limited to addresses 01 to 0F.

<STX> = ASCII 02hex

<SOH> = ASCII 01hex

<CR> = ASCII 0Dhex

AA field = ASCII representation of address 00 means ASCII 30hex twice  
(FF is ASCII 46hex twice)

Data field = ASCII characters 0..9, plus sign, and decimal points  
(punctuation mark and comma are treated equal)

## Supported Protocols

The scoreboard has been designed to interface with various scale terminals and other instruments. The following table lists the instruments that are supported and the protocol number for each. Contact the manufacturer for updated information.

Manufacturer & Model	Auto or Manual	Protocol Number	Manufacturer & Model	Auto or Manual	Protocol Number
A&D INSTRUMENTS			LEON ENGINEERING		
• AD-4326/27	M	P25	• LDS 5204-06 continuous	A	P70
AMBER			MANTRA ELECTRONICS		
• WI-3, WI-6, WI-10	M	P44	• Task 120	M	P52
AVERY-BERKEL			METTLER TOLEDO		
• WG-4	A	P32	• Toledo Continuous	A	P21
• WG-4 Inverted	M	P33	• 8624/MultiCont2	A	P22**
• Standard String #3	A	P34	• 8617/MultiCont1	A	P23**
• L115/117/215/217	A	P20	• ID Series	A/M	P24
• L130	A	P34	• SICS (v. 08.16)	A	P28
• L210	M	P30	• Simple ASCII Format	A/M	P20
• Loadstar XL18	A	P20	• WinBridge	M	P27
CARDINAL			MOLEN WEIGHT		
• 748 Continuous	A	P45	• Simple Format	M	P47
CONSOLIDATED CONTROLS			NORSK DISPLAY		
• Standard	A	P41	• Standard	A	P20
EILON ENGINEERING			• Addressed	A	P20**
• Standard	M	P10	• Demo	M	P54..P57
FLINTAB			• Counter	M	P60
• 47-04 Standard	A/M	P40	PIVOTEX		
• 47-10 Standard	A/M	P40	• Standard Consolidated	A	P41
GARVENS			PRECIA MOLEN		
• STD Format 2	M	P20	• Type I (9 byte)	A	P47
GASSNER			RAUTE PRECISION		
• DMA 02 Junior	A	P42	• WB-900	M	P10
GLOBAL/PHILIPS			RICE LAKE WEIGHING SYSTEM		
• PR 1577 Mode	M	P26	• Standard	A	P41
• PR 1720 Mode	M	P26	SARTORIUS		
• PR 1628	M	P26	• SBI 16 & 22 bytes	A	P59
GSE SCALE SYSTEMS			S-E-G		
• Model 350, 550	M	P51	• Standard	M	P60
HAENNI			THURMAN SCALE		
• Standard	M	P53/P07	• 465 Indicator	A	P41
LASER MIKE			TRAYVOU		
• Model 940	M	P58/P07	• T6000 Indicator	A	P71

\*\* With this protocol, you must use the internal switch array to set the scoreboard's address to something other than 00.

# 6

## Troubleshooting

### Fault Locator

If the scoreboard is not operating properly, use the following table as a troubleshooting guide. It suggests remedies for some basic problems that can cause a scoreboard to malfunction.

NOTE: Before doing any troubleshooting, read Chapter 3 to familiarize yourself with the normal behavior of the scoreboard.

No.	Checkpoint	Action if Checkpoint Fails
1	LED lights are provided on the controller PCB to indicate the status of the power (PWR) and the communication (COM) lines. When power is applied to the scoreboard, the PWR LED should emit light continuously.	Check all connections. Each line must be properly de-isolated and well connected to its terminal block.  Check power supply voltage with and without the scoreboard attached. The voltage must be direct current (DC) between 8 VDC (no backlight) and 25 VDC.
2	When power is applied, the scoreboard should respond with the power-up sequence described in Chapter 3.	Check power connection, and make sure the power source is stable. A battery charger is NOT suitable for supplying the scoreboard.
3	The scoreboard is stuck on the message "CA", meaning that the scoreboard awaits data to determine communication speed.	Check activity on the COM LED on the controller PCB. If the COM LED is "off", the scoreboard is not receiving data.  Check that the correct interface is being used.  Check data line and host instrument for correct settings.
4	The scoreboard is stuck on the message "PF", meaning that the scoreboard awaits data to determine the protocol/ message format.	Check activity on the COM LED on the controller PCB. If the COM LED is "off", the scoreboard is not receiving data.  Check that the correct interface is being used.  Check data line and host instrument for correct settings.  If everything seems fine with LED and baud rate, the host protocol may be unknown to the scoreboard. See item 11 for further information.
5	The scoreboard is stuck on the message "PA", meaning that the scoreboard is unable to analyze the protocol/message format.	Try to reset the scoreboard by recycling the power.
6	The scoreboard reports blank while all decimal points are activated. The scoreboard awaits data.	Check the COM LED blinking status. If in manual mode, check for correct polarity of the signal.
7	An "F" appears at regular intervals on the scoreboard, indicating that a number of communication frame errors have occurred.	Check the baud rate of the host instrument and the baud rate reported by the scoreboard.  Check the polarity of the input data signal.

No.	Checkpoint	Action if Checkpoint Fails
8	The scoreboard intermittently resets itself.	If no valid data is received for the scoreboard, it will reset in approximately 4 minutes (long time-out period). If valid data is received at least every 4 minutes, the display will not reset. If it resets more frequently, the scoreboard controller might be faulty.
9	The scoreboard blanks after 8 seconds.	Most host instruments transmit data continuously to the scoreboard. To prevent old readings from being displayed too long, the short time-out is normally enabled. For most protocols, you can turn off the short time-out by using the remote control.
10	The scoreboard cannot find the correct protocol.	The controller PCB has a TEST push button located close to the onboard switch array. If you press this switch when the power is recycling, the scoreboard will begin a communication test. It will display the first characters for several minutes, allowing you to single-step through the buffer of received characters. This will allow you to see the data presented "as is" (giving valuable feedback on the received message format) and to check that the message contains readable information. This mode can be initiated using the remote control as well.

**Table 6-1: Fault Locator**

At high baud rates and high message frequencies, some protocols can cause flicker and/or error messages. Reducing the communication speed should solve the problem.

## Error Messages

When an internal error occurs, the scoreboard will display an error message briefly. Errors are communicated to the scoreboard from the scale terminal connected to it. The most common errors or events are represented by the symbols shown in Table 6-2.

Event	Display
Waiting for valid data (time-out)	, , , , , (All decimal points set)
Over range indicated by status bit in the data string	- - - - - (All upper segments on)
Under range indicated by status bit	_ _ _ _ _ (All underscore)
Out of range (over or under)	= = = = = (All upper and lower segments)
Not stable (indication not verified)	- - - - - (All minus signs)
Too many digits to present	- - - (Alternate minus and blank)
Error condition	E r r . X X (XX denotes type of error)

**Table 6-2: Error Messages**



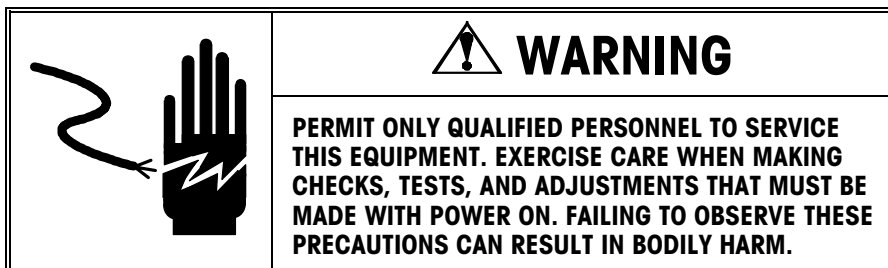
## Error Codes

There are ten types of errors. The actual error codes are two-digit numbers, ranging from 00 to 99. The first number in an error code indicates the type of error. For example, 10 indicates a general communication error while 30 indicates a general conversion error. The most common errors are listed in Table 6-3. The system will detect errors and try to reset or correct itself. Therefore, the error codes are normally displayed only for a short period of time.

Category	Error Code	Description
<b>System Errors</b>	00	General system / internal failure
	01	Reset warm start
	02	Light source failed
	03	Display read back failed
	04	RAM check failed
	05	ROM check failed
	06	Register check failed
<b>Communication Errors</b>	10	General communication error
	11	Time-out occurred
	12	Frame error / baud rate incorrect
	13	Parity error
	14	Receiver overflow (lost characters)
	15	Transmitter overflow (lost characters)
	16	Line break (resting at wrong RXD level)
<b>Protocol Errors</b>	20	General protocol/packet error
	21	Buffer overrun (message is too long)
	22	Checksum failed
	23	Byte count error
	24	Illegal command (not known)
	25	Checksum failed
	26	Illegal character in block
<b>Conversion Errors</b>	30	General conversion error
	31	Under scale / out of range
	32	Over scale
	33	Truncation done (lost precision)
	34	Sender fails (unspecified)

Table 6-3: Error Codes

## Checking Received Data



Most problems can be traced to the scoreboard's power supply and communication lines. The following information explains how to visually inspect the status of the scoreboard to locate a problem without using test equipment.

There are two Light Emitting Diodes (LEDs) on the scoreboard's controller PCB. When the power supply is operating properly, the PWR diode will be lit. When the scoreboard is receiving data, the COM diode will be blinking. If the power supply is operating properly, the source of the problem is probably the data cable, connection, or message format. To check these further, you need to be sure that data is continuously sent from the instrument or PC that is connected to the scoreboard.

1. If the COM diode is not blinking, check the data line connections.
  - Try to switch polarity.
  - If current loop is used, make sure it is actively transmitting (or connect a 20 mA source to the data line).
2. Activate the communication test by pressing the TEST push button located on the scoreboard's controller PCB while power is being recycled. The scoreboard will display the message "FETCH" while it retrieves the data and then will display the received characters "00-20" (00 is the position and 20 is the actual hexadecimal data). You need to be able to understand hexadecimal data or to communicate this information to a qualified service technician. Pressing the TEST button will allow you to see each byte that is received. If 4 minutes passes without the TEST button being used, the scoreboard will reset.

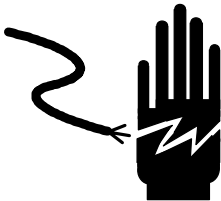
You can also access the communication test function without opening the scoreboard's removable cover. Use the IR remote control to access the TEST selection on the menu, and then press the «YES» button. The only difference is that the scoreboard will automatically step through the data for 4 minutes. NOTE: Make sure the baud rate is set properly before accessing the TEST selection with the remote control.

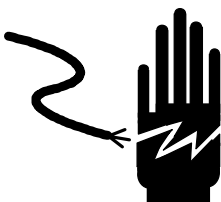
3. Use the data to evaluate the baud rate and protocol. Contact a qualified service technician for help.

# 7

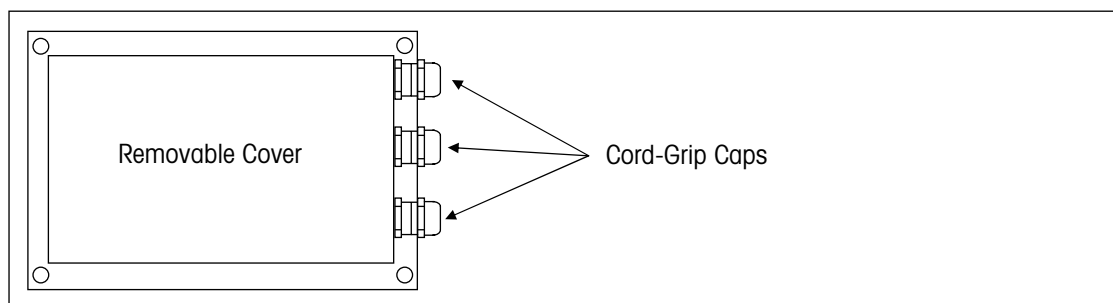
## Parts Replacement

### Accessing Internal Parts

	<p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>PERMIT ONLY QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS, AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.</b></p>
---	--

	<p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>DISCONNECT ALL POWER TO THIS UNIT BEFORE INSTALLING, SERVICING, CLEANING, OR REMOVING THE FUSE. FAILURE TO DO SO COULD RESULT IN BODILY HARM AND/OR PROPERTY DAMAGE.</b></p>
--	--

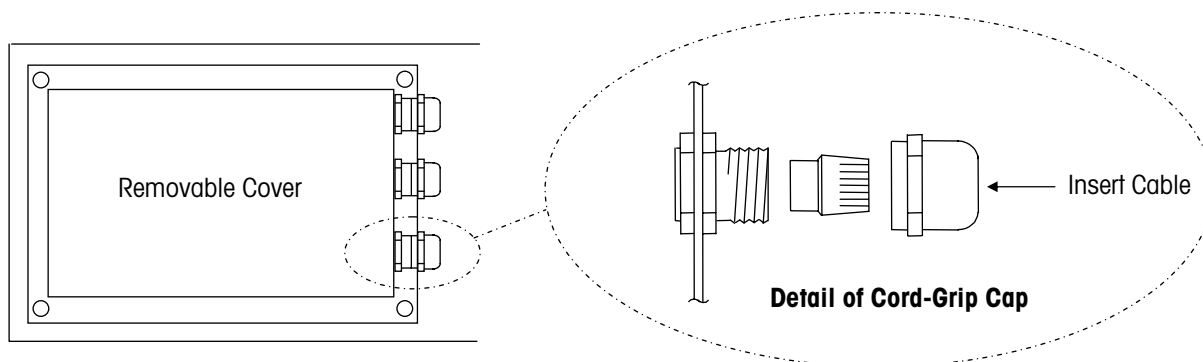
Do not attempt to open the scoreboard enclosure. Opening the enclosure without authorization will affect the warranty. There is a removable cover on the back of the scoreboard (see Figure 7-1) to provide access to the controller PCB, EEPROM, and electrical connections.



**Figure 7-1: Removable Cover on Back of Scoreboard**

#### To remove the cover:

1. Use a T20 Torx screwdriver to remove the four screws that fasten the cover to the back of the scoreboard.
2. Loosen the cord-grip caps enough to slide the cover over the cables and provide access to the internal components (see Figure 7-2). Disconnect the cables if necessary.



**Figure 7-2: Cord Grip Cap**

**To reinstall the cover:**

1. Attach any cables that were loosened.
2. Reposition the cover, making sure that the cables are not squeezed in between the cover and the enclosure.
3. Replace the four screws and tighten them with the T20 Torx screwdriver.
4. Tighten the cord-grip caps and make sure that all seals are secure.

When operating in a dusty or wet environment, please take all possible precautions to prevent dust particles or water droplets from remaining inside the removable cover after servicing. Contamination and humidity may harm the electronics.

## Replacement Parts

The following table lists the replacement parts that are available for the 86180003 scoreboard.

Part Number	Description	Quantity
MZ0302000116	Controller PCB	1
MZ0302000117	Power Supply PCB	1
MZ0302000118	Full Back Cover (includes gasket and screws)	1
MZ0302000121	Gasket and Screws	1
MZ0302000122	Mounting Bracket	1
TA000138	IR Remote Control	1

# 8

## PC Programming Interface

### Protocol P:00

To allow you to field program the scoreboard, there are a number of built-in tools you can use to prepare a new instrument to be interfaced. A special protocol number (P:00) is designed to be a flexible interpreter for normal serial text formats. By using the P:00 protocol, you should be able to capture the values transmitted by almost any host instrument.

With the available free software for Windows™ 95/98 from Norsk Display AS, you can tailor the scoreboard behavior using the procedure listed below. Note that you will have to physically access the controller PCB to permanently store the selection.

1. Make sure the controller is in Auto mode (factory default).
2. Connect the scoreboard to a PC and power it up.
3. Start the PC program "NDConfig" or any suitable terminal program.
4. Select the correct serial port, scoreboard, and instrument type.
5. Press the "Read Display" button if necessary.
6. The scoreboard should respond by displaying "Prog".
7. If the display does not respond, press the "Read Display" button.
8. You can now edit the main parameter window.
9. Set each parameter, or pull down the manufacturer's list for predefined values.
10. Press the "Prog" button in NDConfig and follow the instructions.
11. Make sure that all parameters are accepted.
12. Set the scoreboard in Manual mode (AUTO dip switch is in OFF position). This will save the settings and force the scoreboard to use the programmed features.

The scoreboard behavior for serial setup is briefly described to allow parameter changes by using a terminal or to enable OEM customers to produce their own control program.

Programming mode is accessed by sending a continuous "<Esc>P" sequence after power-up. The scoreboard will respond by displaying "Prog" and transmitting the string "<lf>OK" using the CL output. The serial data response may be discarded, but will provide a valuable feedback for automated, sequenced programming. Every command is issued with an allowed response time for feedback: "<lf>OK" when command is judged valid and "<lf>\*ERR" for invalid commands. As an additional service, the scoreboard will display "Error" if the last processed command contained illegal characters or sequences. Only capital letters are allowed in commands, while string parameters are processed as is. Note that every key pressed on a terminal is sent to the scoreboard, and editing (backspace, etc.) is not supported.

All commands are terminated by a CR (Carriage Return ASCII 13dec).

## GLOBAL INFLUENCE

Command	Syntax	Description	Valid Parameters [Default]
Status Request	S	Status request will dump all programmable settings to the serial output.	No parameters
Communication Speed	C=<number>	Sets the communication baud rate.	00 (=Auto), 300 to 38,400 [00=Auto]
Communication Data Bits	D=<number>	Sets the number of data bits.	"7" or "8" [7]
Communication Parity	P=<character>	Sets the parity scheme.	N(one), E(ven), O(dd) [E]
Manual Protocol Select	MP=<hexnumber>	Allows you to set the protocol interpreter. Note that only MP=00 will override the switch array Auto mode setting, while all other protocol numbers will be active only in Manual mode (AUTO dip switch is in OFF position).	"00" to "FF" [20]  Note the ASCII hex representation. MP=20 represents STX-data-CR message format.
Scoreboard Address	A=<number>	Sets the scoreboard address for some special protocols. Switch array settings override this software setting. Used only for special protocols.	"00" to "99"  Address is programmed and reported in decimals
Time-Out Period	TO=<number>	Number of seconds before display is blanked and protocol interpreter is re-initiated. Note that many protocols have a fixed setting of this time-out.	"0" to "99" [10]  "0" disables the time-out  Time-out is approximately 8 seconds
Request String	RS=<string>	Request string defines the string or single character to send back to the host instrument (for example, to initiate transmission). The request string is sent 1 second before time-out. Most protocols do not require a request string to be used.	String, max. 10 characters  Use ^ prior to a printable character to denote a CTRL-character (for example, ^A is ASCII 00h)

**PROTOCOL 00 INFLUENCE ONLY**

Command	Syntax	Description	Valid Parameters [Default]
Protocol Start	PS=<number>	Defines the start character of a valid message.	"0" to "99" [2=STX] 0 means no specific
Protocol End	PE=<number>	Defines the end character of a valid message.	"0" to "99" [13=CR]
Text Ignore	TI=<number>	Instructs the scoreboard to ignore the N first characters in a message.	"0" to "99" [0] 0 disables the function
Text Length	TL=<number>	Only the value represented in the N first characters (after TI) of the message should be displayed.	"0" to "99" [0] 0 disables the function
Decimal Point	DP=<number>	Allows you to set a "fixed" decimal point or multiply the value by 10, 100, or 1000 (adding one, two, or three zeros after the received value).	"0" to "9" [0] 0: no modification 1,2,3,4,5: decimals 6,7,8,9: x10, x100, x1000
Sign Position	SP=<number>	Indicates the byte position of the sign (plus or minus). If the sign is represented as a part of the value, this feature is not used. SP=1 means first byte after Protocol Start.	"0" to "99" [0] 0 means inactive
Sign Bit	SB=<number>	If negative numbers are represented by a bit set to "1", then this bit position is set.	"0" to "8" [0] 0 means not in use bit 1 (lsb) to bit 8 (msb): sign indicator

Typical programming cable for a PC connected via RS-232:

Standard Cable Color	Scoreboard Signal Name	Pin No. on 9-Pin Dsub	PC Signal Name
Pink	V+	(Connects to +8...24VDC on external power/battery)	-
Gray	OV	5 (Connects to 0VDC on external power/battery)	-
Blue	+RxD	3	TxD
Blue+Red	-RxD	5	GND
Red	SO	(Connects to V+: pink conductor)	-
Green	+O	2	RxD
Yellow	-O		-





**METTLER TOLEDO**

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