

Part No. 52 800 244

Turbidity Transmitter Trb 8300

Instruction Manual

METTLER TOLEDO

The logo graphic consists of a series of parallel, slightly curved lines that form a diamond or arrow-like shape pointing downwards and to the right. The lines are more densely packed in the center and become sparser towards the edges.

IMPORTANT SAFETY INFORMATION

- Follow all warnings, cautions, and instructions indicated on and supplied with this product.
- Install equipment as specified in this instruction manual. Follow appropriate local and national codes.
- Use only factory documented components for repair. Tampering or unauthorized substitution of parts and procedures can affect the performance and cause unsafe operation of your process.
- Protective covers must be in place unless qualified personnel are performing maintenance.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by it against hazards may be impaired.

WARNINGS:

- Installation of cable connections and servicing of this product require access to shock hazard voltage levels.
- Main power and relay contacts wired to separate power source must be disconnected before servicing.
- Main power must employ a switch or circuit breaker as the disconnecting device for the equipment.
- Electrical installation must be in accordance with the National Electrical Code and/or any other applicable national or local codes.
- Safety and performance require that this instrument be connected and properly grounded through a three-wire power source.
- RELAY CONTROL ACTION: the Trb 8300 instrument relays will always de-energize on loss of power, equivalent to normally open state, regardless of relay state setting for powered operation. Configure any control system using these relays with fail-safe logic accordingly.
- PROCESS UPSETS: Because process and safety conditions may depend on consistent operation of this instrument, provide appropriate means to maintain operation during sensor cleaning, replacement or sensor or instrument calibration.

This instrument complies with the safety standards as outlined on our Ratings.

This manual includes safety information with the following designations and formats:

WARNING: POTENTIAL FOR PERSONAL INJURY

CAUTION: possible instrument damage or malfunction

NOTE: important operating information

Definition of Equipment Symbols



On the instrument indicates: Caution, risk of electric shock



On the instrument indicates: Caution (refer to accompanying documents)



On the instrument indicates: There is alternating current (AC) present.

TABLE OF CONTENTS

CHAPTER 1:			
INTRODUCTION	1	Sensor..... 14	
At the very beginning	1	Units..... 14	
Intended Use.....	1	Name..... 14	
Description of Unit.....	1	Calibration Menu	14
Measurement and Control System.....	2	Milliamp Outputs Menu.....	14
		mA output #.....	14
CHAPTER 2:		Scaling Type	15
INSTALLING THE Trb 8300	3	Low Value	15
Unpacking	3	0/4 mA.....	15
Instrument Description	3	Mid	15
Instrument Installation	5	20 mA.....	15
Panel Mount.....	5	Num of Decades	15
Wall Mount.....	5	On failure 22 mA	15
Connections	6	Current out	15
Input Power.....	6	Set Hold Mode.....	16
Sensor Connections.....	7	Filter	16
Other Connections.....	8	Relays Menu.....	16
Initial Start-Up	9	Select Relay	16
Display Contrast Adjustment.....	9	Limit 1 and 2	17
		Value	17
CHAPTER 3:		Delay.....	17
GETTING STARTED	10	Hysteresis	17
Operating Modes.....	10	Set Point.....	17
Measure Mode.....	10	State.....	17
Menu Mode.....	10	Alarm	17
Using the Display and Keypad	11	Delay	17
Display	11	State.....	17
Keypad.....	11	Use alarm if mA outputs are	
Data Entry.....	12	under-/over-range	17
		Wash	17
CHAPTER 4:		Interval	17
USING MENUS	13	Wash Time	17
Introduction	13	State.....	18
Main Menu	13	Save/Recall Menu	18
Access	13	Select	18
Exit.....	13	P-Set	18
Parameter Set Menu	14	Reset Menu	18
Parameter Set.....	14	System	18

P-Set.....	18
Cal	18
Security Menu	19
Go to.....	19
Change Lockout.....	19
Change Password	19
Lockout status.....	19
Diagnostics Menu.....	19
Sensor	20
Self Tests.....	20
Relays.....	20
Inputs.....	20
Serial Port.....	20
Meter.....	20
Keypad.....	20
Display	20
mA Output.....	20
Language Menu	20
Other Menus	20
Set Date/Time	20
Set Unit Name	20
Lost Passwords	20
RS232 set-up.....	20
Print Configuration	21
Software Revs	21
Service Only	21

CHAPTER 5:	
CALIBRATIONS.....	22
Introduction	22
Calibration Types	22
Calibration Menu	23
Manual Calibration.....	23
Multipoint Calibration	23
Process Calibration.....	24
Typical Applications	24
Crystallization	24
Fermentation.....	25
Suspended solids in waste water.....	25
Calibration with Turbidity Standards ...	25
Solids/Liquid separation process	25
Dry calibrations with CaliCap	26

CHAPTER 6:	
MAINTENANCE & TROUBLESHOOTING	27
Maintenance	27
Front Panel Cleaning	27
Troubleshooting Checklist	27

CHAPTER 7:	
UPGRADE.....	28
Upgrades.....	28
Main Program Software Upgrade.....	28

CHAPTER 8:	
ACCESSORIES AND SPARE PARTS	30

APPENDIX A:	
MENU TREES	31

APPENDIX B:	
SET-UP PARAMETER RECORD... ..	43

APPENDIX C:	
SPECIFICATIONS.....	45

APPENDIX D:	
RATINGS.....	48

APPENDIX E:	
WARRANTY	49

CHAPTER 1: INTRODUCTION

AT THE VERY BEGINNING

We thank you for having purchased the METTLER TOLEDO Turbidity Transmitter Trb 8300.

This manual covers routine operation, service and communication of the Trb 8300.

The instruction manual must always be stored close at hand, in a place accessible to all persons working with the turbidity Transmitter Trb 8300.

If you have questions, which are not or insufficiently answered in this instruction manual, please contact your METTLER TOLEDO supplier. They will be glad to assist you.

INTENDED USE

The METTLER TOLEDO Turbidity Transmitter Trb 8300 combined with InPro®8000 sensors are intended solely for measurements in liquids, as described in this instruction manual. Any other use, or use not mentioned here, that is incompatible with the technical specifications is deemed inappropriate. The operator is solely responsible for any damage arising from such use.

Other prerequisites for appropriate use include:

- Observing the instructions, notes and requirements set out in this instruction manual.
- Observing all local safety regulations concerning safety at work.
- Observing all information and warnings in the documentation dealing with products used together with the transmitter (sensors, housings etc.)
- Observing the prescribed environmental and operational conditions

DESCRIPTION OF UNIT

The Trb 8300 is a transmitter for high accuracy measurement and control. It accepts input from METTLER TOLEDO InPro8000 fiber optic sensor series only.

This manual describes the operation of both, 100...240 VAC and 20...32 VDC power supply version of the Trb 8300.

A system consisting of the Trb8300 transmitter and an InPro8000 fiber optic sensors measures:

- **turbidity**
- or
- **concentration of suspended (undissolved) particles**

InPro8000 sensors are rapidly installed using fixed fiber optic cable or additional patch cords up to 170 m (520 ft) long with two SMA type connectors at both ends.

Fiber optic sensors – type OFS12...I, ..N and ...H used with the previous generation FSC402/II instrument are fully compatible with Trb 8300.

The measuring system can be used for applications in biotechnological, chemical and wastewater processes, such as for the measurement of undissolved (suspended) particles and turbidity.

The transmitter has many user-friendly and safety features which include:

- Manual, Process and Multipoint Calibration procedures
- three retrievable, independently configurable Parameter Sets with remote access via digital inputs
- full text menu guide in three languages
- online help texts
- menu password protection on two levels
- four 0/4...20 mA outputs galvanically isolated from the measurement circuitry according to NAMUR NE43 guideline
- 2 programmable limit setpoints, 1 alarm relay (SPDT type)
- Wash contact (SPDT type) and HOLD input
- RS232 interface for data transfer of configurations and software updating

Turbidity and suspended particles measurements take advantage of the interaction of light and particles. The light source installed in the transmitter is a near infrared light emitting diode (NIR-LED) with a wavelength of 880 nm. The receiver consists of a silicon photodiode. The Trb 8300 determines the turbidity value 500 times per second ensuring optimum compensation of external light. The signal is measured over an average time of 100 milliseconds in order to ensure a good signal-to-noise ratio. To eliminate interference, additional zero point and reference signals are measured.

Appropriate METTLER TOLEDO InPro8000 series turbidity sensors take advantage of the backscattered light technology. Consequently a wide linear measuring range is provided and resolution weaknesses are avoided.

The use of the fiber optic technique enables a sensor design with uniform, unbroken surface structure and consequently freedom from fouling and with easy cleanability.

Furthermore, a compact METTLER TOLEDO 12 mm design can be realized with the fiber optic technique. Therefore sensors can be installed in small laboratory/pilot plant reactors and in commercial-scale production vessels by using standard METTLER TOLEDO housings.

MEASUREMENT AND CONTROL SYSTEM

A typical measurement system consists of:

- Turbidity process transmitter Trb 8300
- A fiber optic sensor, InPro8050, InPro8100 or InPro8200
- A METTLER TOLEDO fiber optic cable
- A process, immersion or flow assembly
- A final control element such as pump or valve
- Device for recording measured values

CHAPTER 2: INSTALLING THE Trb 8300

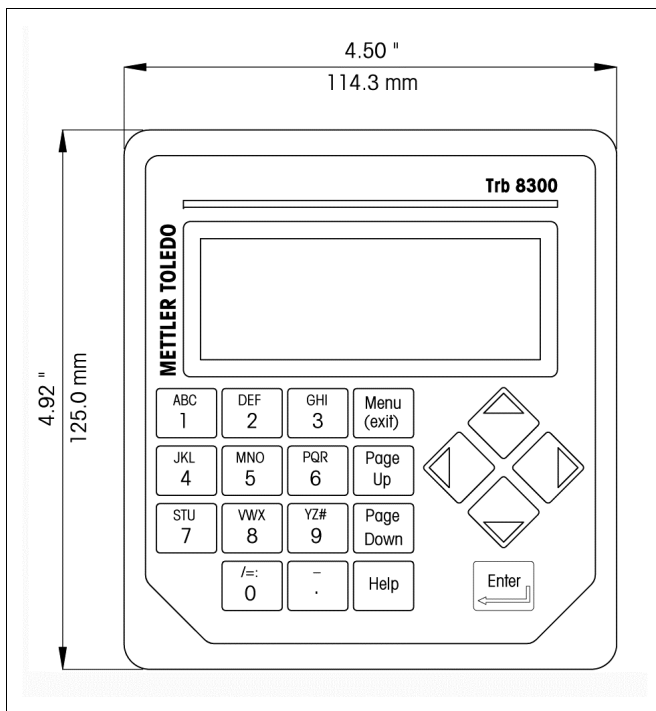
UNPACKING

Carefully unpack the Trb 8300, the carton should contain:

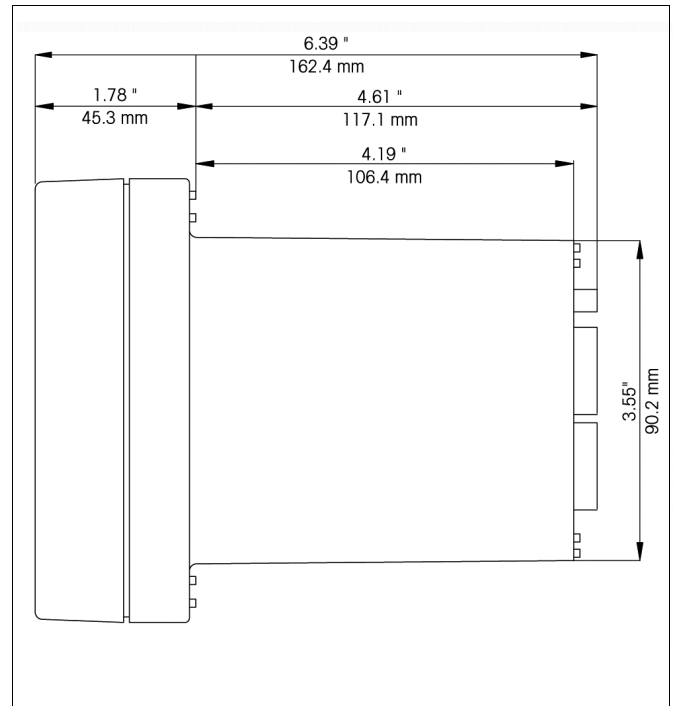
- Trb 8300 instrument
- Trb 8300 Instruction Manuals (English, French and German versions)
- Ferrite suppressor module (only with 20...32 VDC transmitter version)
- mounting screws, 4
- panel mounting gasket
- Connector blocks for TB2, TB3, TB5, TB6

INSTRUMENT DESCRIPTION

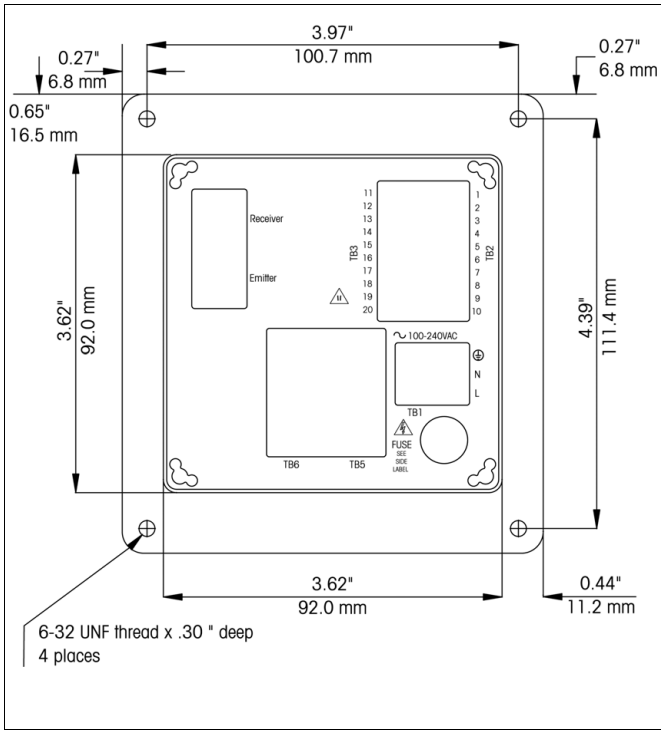
Shown below are the Trb 8300 enclosure dimensions:



front dimensions – [mm] inches



side dimensions – [mm] inches



rear dimensions – [mm] inches

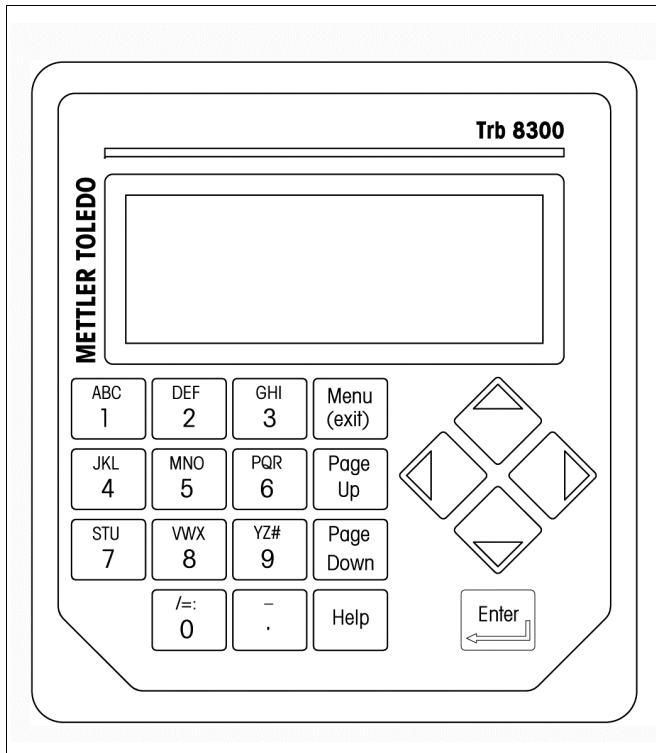
Front Panel

Display:

The backlit LCD display has four lines of 20 characters each.

Keypad:

The keypad consists of 9 function keys and 11 alphanumeric entry keys. See **Chapter 3: Getting Started** for a detailed description of each key.



front panel

Rear Panel

All electrical, relay, input, output, and communication connections are made via the rear panel of the Trb 8300. See **CONNECTIONS** later in this section.

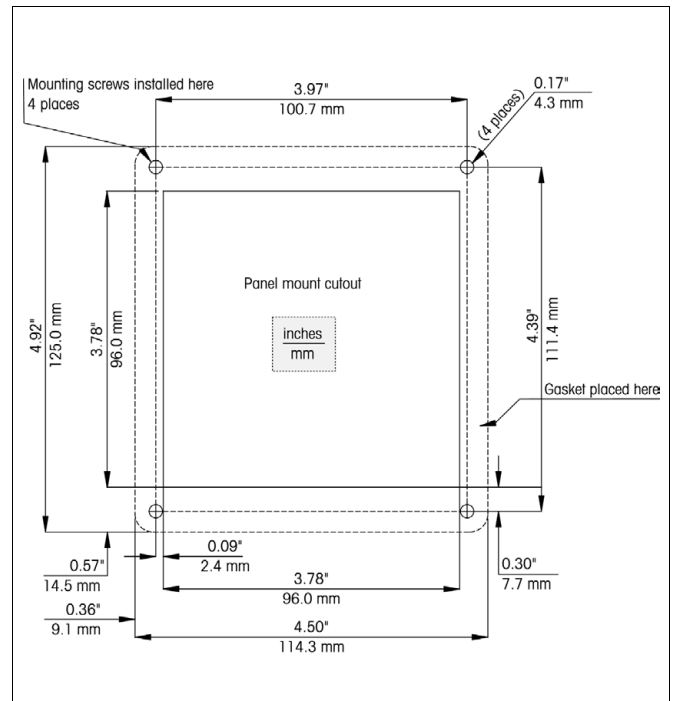
INSTRUMENT INSTALLATION

Panel Mount

The Trb 8300 is supplied with four mounting screws and a gasket to provide a seal at the panel cutout.

To mount the Trb 8300 in an instrument panel:

1. Use the illustration below to mark panel cutouts.



panel cutout – [mm] inches

If multiple instruments are to be mounted in the same panel, allow enough space for the flanges to overlap the panel between instruments (dotted outline).

2. Make the panel cutout and drill the mounting screw holes; all cutouts should be clean and free of burrs.
3. Remove the backing paper and slide the adhesive gasket onto the rear of the instrument flange. Align it evenly and press into place. The two small pins near each screw hole are intended to control compression of the gasket for optimum sealing.
4. Slide the Trb 8300 into the panel and secure with four 6-32 mounting screws (supplied) from the back.

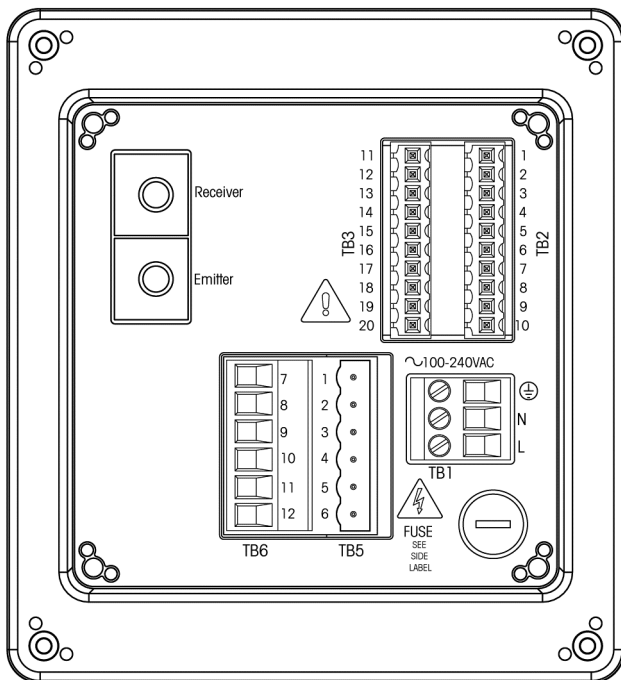
Wall Mount

For wall mounting the transmitter Trb 8300 needs to be installed in an additional IP65 (NEMA 4X) field housing (METTLER TOLEDO part number 52 800 864).

CONNECTIONS

All connections are made via the rear panel. InPro8000 series sensor connectors are marked with EMITTER and RECEIVER. Outputs on TB2 and TB3 include 4 analog outputs, RS232 plus 4 discrete inputs. Four relays are on TB5 and TB6.

Caution: The long term bend radius of 10 cm (4") for the fiber optic cable has to be taken into consideration when connecting the fiber optic cables to the connectors EMITTER and RECEIVER . This means that a clearance of at least 15 cm (10 cm plus 5 cm for sensor connectors) (6") is needed behind the transmitter.



rear panel terminal boards

WARNING: MAKE SURE POWER TO ALL WIRES IS TURNED OFF BEFORE PROCEEDING WITH THE INSTALLATION. HIGH VOLTAGE MAY BE PRESENT ON THE INPUT POWER WIRES AND RELAY WIRES.

Acceptable wire sizes for Trb 8300 terminals are from 22 AWG (0.326 mm²) to 14 AWG (2.08 mm²) for all connections except relays. For TB5 and TB6 relay terminals use 26 AWG (0.126 mm²) to 14 AWG (2.08 mm²). If more than one wire has to be connected to a terminal, wire size must be further limited.

Acceptable wire sizes for TB1 for the 20...32 VDC transmitter version are from 22 AWG (0.326 mm²) to 14 AWG (2.08 mm²)

Input Power

The Trb 8300 **part number 52 800 204**, has a universal power supply for operation in the range of **100-240 VAC, 47-63 Hz**.

Terminal block TB1 provides the connections for the input line power. See above section for wire sizes. Turn the terminal screws fully counterclockwise, then insert the appropriate wire into its terminal and securely tighten adjacent screw.

CAUTION: a full 0.5 in. (13 mm) of bare conductor must be exposed for reliable power connection to these deep terminals. This is much more than is required for other terminals. For AC power, make connections as follows:

Board	Terminal	Connection
TB1		Earth ground
	N	AC power, neutral
	L	AC power, hot

The Trb 8300 , **part number 52 800 906**, has a universal DC power supply for operation in the range of **20...32 VDC**. The enclosed ferrite suppressor module must be installed on the 24 VDC power cable to meet CE requirements. Pass the DC power cable through the ferrite suppressor module, then loop it through one more time before connecting the transmitter to the power source. Place ferrite as close to the transmitter as possible. For DC power, make connections as follows:

Board	Terminal	Connection
TB1		Earth ground
	PS-	DC power, minus
	PS+	DC power, plus

WARNING: MISWIRING THE POWER MAY CAUSE A HAZARD, DAMAGE THE INSTRUMENT AND WILL VOID ALL WARRANTIES.

Sensor Connections

Use the two connections labeled EMITTER and RECEIVER on the rear panel for connecting METTLER TOLEDO InPro8000 sensors only. Patch cords are available up to 170 m (500 ft m) in length. Mismatching the two ends of a sensor cable is not possible.

Hand-screwed fixing only of the two SMA connectors of the sensor cable on the transmitter connectors is recommended.

CAUTION: Do not cut or shorten fiber optic cables. Cutting of fiber optic cables and assembly of SMA connectors require special tools. Where it is desired to use shorter patch cables, consult your METTLER TOLEDO supplier.

See the appropriate sensor instruction manual for detailed information regarding installation and specific use of fiber optic sensors.

Fiber optic sensors – type OFS12...I, ..N and ...H used with the previous generation FSC402/II instrument are fully compatible with the Trb 8300.

Other Connections

Each connection terminal and terminal block are labeled by number. The following tables identify each connection.

Board	Terminal	Connection
TB2	1	Do not use !
	2	Return Parameter Set A, B and HOLD
	3	Do not use !
	4	Parameter Set B
	5	Do not use !
	6	HOLD
	7	Parameter Set A
	8	RS232 ground
	9	RS232 receive
	10	RS232 transmit
TB3	11	Do not use !
	12	Return Parameter Set C
	13	Parameter Set C
	14	Do not use
	15	Analog mA output 4 +
	16	Analog mA output 3 +
	17	Analog mA output -
	18	Analog mA output -
	19	Analog mA output 2 +
	20	Analog mA output 1 +
TB5	1	Alarm, normally closed
	2	Alarm common
	3	Alarm, normally open
	4	Wash, normally closed
	5	Wash, common
	6	Wash, normally open
TB6	7	Limit 1, normally closed
	8	Limit 1, common
	9	Limit 1, normally open
	10	Limit 2, normally closed
	11	Limit 2, common
	12	Limit 2, normally open

Discrete Inputs

Discrete (digital) inputs (TB2-4,6,7 and TB3-13) allow external dry isolated contacts to pull their +5V logic level to common (TB2-2 and TB3-12) to provide discrete control action within the Trb 8300. This control may be used to hold the current (mA) outputs (see **Chapter 4** Set HOLD Mode) and to select one of three Parameter Sets .

CAUTION: Route wiring to discrete inputs away from power or switching circuits and provide shielding to an earth ground at the far end of the cable.

Current (mA) Outputs

Connections for current outputs are on TB3. Note that connections use common terminal (18) for current outputs 1 and 2 and common terminal (17) for current outputs 3 and 4. Current outputs are self-powered and have a maximum load capacity of 500 ohms.

CAUTION: Do not connect current outputs to circuits supplying power. They are already powered.

INITIAL START UP

When power is first supplied to the Trb 8300, a message similar to the following will be displayed:

```
*****  
METTLER TOLEDO  
Model vX.XX  
*****
```

The second line indicates the instrument main software version.

After initialization, the display will go to measurement mode.

Display Contrast Adjustment

Depending on ambient lighting and temperature conditions, some adjustment of the LCD display contrast may be needed. Allow the instrument to warm up to operating conditions before making an adjustment. Loosen the two captive front panel screws and lift the front panel off. Using a fine screwdriver, adjust the small potentiometer on the left side below the display to obtain the desired contrast. Replace the front panel.

CHAPTER 3: GETTING STARTED

Please read this chapter for an overview of the Trb 8300. It will help you understand the operating system and how to use the display and keypad for data entry.

The following chapters provide detailed information on using the Trb 8300:

Chapter 4: Using Menus – understanding the menu system, options, and configuration for your applications.

Chapter 5: Calibrations – understanding the different types of calibrations available, manual, process, and multi point calibrations.

For help diagnosing and resolving measurement problems, see **Chapter 6: Troubleshooting**.

OPERATING MODES

The Trb 8300 has two operating modes:

- **Measure** – used to present measurement data; the instrument will usually be in this mode.
- **Menu** – used to set up the system for your specific applications and access all other operational features.

Measure Mode

Three Parameter Sets can be configured in the Trb 8300. In display mode, the measurement of the active Parameter Set (P-Set) is displayed.

P-Sets

Parameter Sets (P-Sets) are termed A through C. In each P-Set the instrument can be configured according to the requirements of a specific application. Each configuration includes calibration, ranging of current outputs, definition of setpoints, and wash intervals and lengths. If the application changes the corresponding P-Set can be retrieved, modified and saved again if necessary. This feature is extremely helpful if the sensor is installed in a vessel in which different batch processes have to be monitored.

Measurement Units

The selection of the measurement units available depends on the type of process being monitored. Turbidity and undissolved particle measurements are always relative measurements. Therefore the whole loop (sensor, patch cable and transmitter) has to be calibrated with the process media itself or with turbidity standards, typically commercial Formazin solutions.

The Trb 8300 accommodates the following measurement units:

- FTU – Formazin Turbidity Units
- NTU – Nephelometric Turbidity Units
- EBC – European Brewery Convention
- ppm – Parts per million
- g/l – grams per liter
- %

The turbidity values FTU, NTU or EBC are used if the system is calibrated with Formazin or the corresponding turbidity value of the process media is known, i.e. by grab sample measurements with laboratory turbidimeters calibrated in FTU, NTU or EBC.

% is used for samples with unknown turbidity characteristics. The operator defines “turbidity” units on a relative 0-100 % scale.

ppm or g/l is used when the undissolved solid content has been determined by an alternative measurement, i.e. dry mass measurements of grab samples.

Menu Mode

Menu mode allows you to set up the Trb 8300 specifically for your applications.

The Main Menu consists of many sub-menus in a loop, which can be scrolled through for easy access. These sub-menus allow you to:

- Define Parameter Sets
- Calibrate the system
- Define current (mA) outputs
- Define limit setpoints and wash intervals
- Save/Retrieve Parameter Sets
- Reset different configurations
- Define Security levels
- Perform diagnostic functions
- Define your dialog language

Each menu may consist of one or more screens, or pages, where you define the desired settings.

The remainder of this chapter describes how to use the keypad and display to define settings and enter information in menu mode.

The next chapter, **Chapter 4: Using Menus**, details the content of each menu.

USING THE DISPLAY AND KEYPAD

The Trb 8300 operating system is very straightforward, but understanding a few rules will make it easier to navigate.

Display

The four-line display provides read-out of measurement data as well as all menu screens and data entry fields.

Most display information and prompts are self-explanatory, for further assistance press «**Help**» and page down to read the message. Press «**Help**» again to return to the original screen.

If an up or down arrow is shown on the right side of the display, then more screens of information are available.

A flashing value in the display mode indicates a setpoint for that measurement has been exceeded. A high alarm condition is indicated by ">" after the value. A low alarm condition is indicated by "<".

A flashing "H" on the display indicates that the transmitter is in HOLD mode. A flashing "Process Cal" in the measurement display indicates that a Process Calibration has been started and is waiting to be finished (see Chapter 5: Calibrations). Example display:

```
Measurement
P-Set A (Process1)
400.2 FTU
Process Cal H
```

A letter before the measurement unit indicates a multiplier. The units multipliers are:

- m (milli) = multiply value by 0.001 (10^{-3})
- _ (units) = multiply value by 1

Keypad

The keypad consists of 9 function keys and 11 alphanumeric entry keys.

«Menu (exit)»

Press «**Menu (exit)**» to access the menu mode. Press «**Menu (exit)**» again to exit the menu mode.

«Page Up» / «Page Down»

Press «**Page Down**» to move to the next screen of information (if any). Press «**Page Up**» to move to the previous screen of information (if any). Additional screens are indicated by an up or down arrow on the right side of display.

When finished with a data entry screen, press «**Page Down**» to go to the next one.

«Help»

Press «**Help**» to view more information or instructions regarding the current screen or data entry field.

Press «**Page Up**» or «**Page Down**» as necessary to view the entire message. Press «**Help**» again to return to the original screen.

«Enter»

Press «**Enter**» to select a menu option, to select an option from a list, to complete an alphanumeric entry, or move to the next data entry field.

Arrow keys

The four arrow keys function as follows:

- «' » – press to view the next item in a list of options.
- « ` » – press to view the previous item in a list of options.
- «" » – press to move the cursor left in a line of text or numbers (may also move cursor to the previous field).
- «>» – press to move the cursor right in a line of text or numbers (may also move cursor to the next field).

Alphanumeric keys

The alphanumeric keys are multi-functional. For example, the «1» key can be used to type the letters "A, B, C" in either upper or lower case, as well as the numeral "1."

Repetitive presses of the same key produce the different entries. Using the «1» key as an example:

- first press = A
 - second press = B
 - third press = C
 - fourth press = a
 - fifth press = b
 - sixth press = c
 - seventh press = 1
- then the sequence repeats.

Notes:

The «0» key will yield the following characters: / = : () 0

The «-» key will yield the following characters: . - + ^ _ ! \$

If another letter from the **same** key is desired, the «>>» arrow key must be used to move the cursor to the next position in the data entry field.

When a **different** key is pressed, the cursor automatically moves to the next position.

If a lower case letter is selected, the next key pressed will begin the sequence with the lower case.

The «'» and «`» arrow keys can be used to scroll through the entire alphabet.

If the Trb 8300 is expecting a numeric entry, the first press will yield the number on the key.

Data Entry

In menu mode, each line of the display presents an option followed by a data entry field.

If a colon ":" follows the field name, use the «'» and «`» arrow keys to scroll through a list of options.

If an equal sign "=" follows the field name, use the alphanumeric keys to enter the required information. (See **Alphanumeric Keys** above.)

When the desired option is selected or the alphanumeric entry complete, press «Enter» to move the cursor to the next field. (When the last field on a screen has been completed, pressing «Enter» will return the cursor to the top of the screen.)

If the menu consists of more than one screen of fields, press «Page Down» to continue.

CHAPTER 4: USING MENUS

INTRODUCTION

After installation is complete, use the menu system to set up the Trb 8300 for your measurements.

First, set up the Parameter Set for each application.. Then go through the rest of the menus for calibration and to set any outputs, setpoints, relays and other functions as necessary. Menu selections are automatically saved as you make them, although on exiting menus you can restore previous settings.

If desired, photocopy the Measurement Parameters Record form provided in **Appendix B** to record the menu options selected.

After all menu options have been set, return to display mode to view measurement readings.

MAIN MENU

The Main Menu is used for all instrument functions except the actual display of measurements. The following sub-menus are available from the Main Menu:

- **Parameter Set** – define measurement unit and name of P-Set.
- **Calibration** – select and perform the appropriate calibration routine for your measurement.
- **mA Outputs** – scale current outputs, and define HOLD mode and type of signal filtering.
- **Relays** – define limit setpoints, type (high, low), alarm relay action, and wash cycles.
- **Save/Recall** – activate a P-Set by recalling it or save your current settings to a P-Set.
- **Reset** – return settings to default values.
- **Security** – enable password protection.
- **Diagnostic** – access a series of diagnostic testing routines.
- **Language** – select your dialog language (English, German or French)
- **Other Menus** – access to less commonly used menus.
 - Set Date/Time** – enter date and time.
 - RS232 Set-up** – format the Data output communication parameters
 - Software Revs** – display revision of installed software.
 - Print Config** – print current set-up information via the RS-232 port.
 - Set Unit Name** – enter a descriptive name for this instrument.
 - Lost Passwords** – retrieve lost passwords.
 - Service Only** – for use by METTLER TOLEDO Service personnel only.

Access

To access the Main Menu, press «**Menu (exit)**». If security is active, a prompt for a password will appear.

Press the «' » or «'`» key to step through the main Menu. Press «**Enter**» to select a menu.

NOTE: Access to menu functions can be password protected for security. If you are locked out, you can still review settings but not change them. Press any alphanumeric key as the (wrong) password and press «**Enter**» to review menu settings.

Exit

After completing all data entry for one menu option:

- Press «**Page Up**» until you return to the Main Menu to select another menu option; or
- Press «**Menu (exit)**» twice to save settings, exit the menu system and return to display mode.
- If no keys are pressed for 5 minutes, the Measure mode will resume automatically and settings will be saved.

To exit menus and **discard** any changes made:

- Press «**Menu (exit)**» once and then press «**1**» to exit the menu system, revert to the prior menu settings, and return to the display mode.

PARAMETER SET MENU

Parameter Set

Three different Parameter Sets may be defined in the system memory. Each Parameter Set definition will be identified by a letter (A through C) which will become a line on the display in the normal measuring mode and other menus as P-Set.

Sensor

The designation "BW" indicates that you are currently using a METTLER TOLEDO backward scattering light sensor, Series InPro8000.

Units

The Trb 8300 accommodates the following measurement units:

- FTU – Formazin Turbidity Units
- NTU – Nephelometric Turbidity Units
- EBC – European Brewery Convention
- ppm – Parts per million
- g/l – grams per liter
- %

The turbidity values FTU, NTU or EBC are used if the system is calibrated with Formazin or the corresponding turbidity value of the process media is known, i.e. by grab sample measurements with laboratory turbidimeters calibrated in FTU, NTU or EBC.

% is used for samples with unknown turbidity characteristics. The operator defines "turbidity" units on a relative 0-100 % scale.

ppm and g/l is used when the undissolved solid content has been determined by an alternative measurement, i.e. dry mass measurements of grab samples.

Select the correct unit for your application before accessing other menus.

Name

Each Parameter Set can be given a custom name for easier identification (up to eight alphanumeric or symbol characters). If a name is not entered, the Parameter Set will default to "none". The name may be overwritten as desired.

Note: See **Chapter 3: Getting Started** for instructions on using the alphanumeric keys

To exit the Parameter Set menu see Chapter 4: Using menus.

CALIBRATION MENU

The Calibrate Menu is used to calibrate the complete measuring loop according to the requirements of your

application. For detailed calibration instructions, see **Chapter 5: Calibrations** including proposals for typical applications.

The Trb 8300/InPro8000 turbidity systems are not factory calibrated. Accurate calibration and understanding specialties of fiber optic sensors is absolutely necessary for accurate measurements.

CAUTION: A calibration of the system before making measurements is mandatory !

MILLIAMP (mA) OUTPUTS MENU

The 0/4-20 mA Outputs Menu is used to assign current outputs to measurements and define any necessary options. Furthermore HOLD Mode and Signal Filters for all four outputs are defined.

NOTE: Outputs are programmed to fulfill requirements of NAMUR NE43. This means that in an over-range condition, the outputs will be set to 20.5 mA. In an under-range condition the outputs will be set to 0 mA or 3.8 mA (if low value is set to 4 mA).

Use the «' » and « ` » arrow keys in the mA Output menu to select mA-Output # (= number), then press «Enter» to continue with setting up one of the current outputs.

Four current outputs are provided. Each output can be programmed to operate as a normal (i.e., linear), bi-linear, auto-range, or logarithmic output and to send a 22 mA signal if a system failure is detected.

See **Chapter 2: Installing the Trb 8300** for connection information.

mA Output

Use the «' » and « ` » arrow keys to select the desired output (1 through 4), then press «Enter» to continue with set-up for that output. Complete all set-up parameters for one output before starting another.

To set up the next output, press «Page Up» until you return to the initial current output screen and then select another current output number.

Scaling Type

The following types of output scaling are available: normal, bi-linear, auto-range, and logarithmic.

Normal scaling provides a linear 4 mA (or 0 mA) to 20 mA output. Low and high measurement values can be entered to correspond to those outputs.

Bi-linear scaling provides two scaling ranges for a single linear strip chart: usually a wide measurement range at the high end of the scale, and a narrower range with high resolution at the low end.

In addition to entering low and high values, a mid-range scaling value must be defined. For example, a user may want to monitor a particle breakthrough into the liquid phase during a liquid/solids separation process. Measurements are normally in the range of 5-20 FTU but during a particle breakthrough, a range of up to 200 FTU is desirable. Settings for the low, mid and high values might be 5, 20 and 201 FTU, to give convenient plotting on a 10-division strip chart.

Auto-Range scaling provides two ranges of output. It is designed to work with a PLC or two points of a multipoint strip chart recorder to meet the same needs as bi-linear scaling above.

Two separate settings are used, one for the high limit of the high range and one for the high limit of the low range, for the single 0/4-20 mA signal. The low value is always zero.

For the particle breakthrough example above, with rising concentration, the 0/4-20 mA signal would go from 0-100% for 0-20 FTU, decrease to 10% , then go 10-100% for 20-200 FTU. Thus both 0-20 and 0-200 FTU ranges may be recorded on the same chart using a single signal.

Logarithmic scaling provides an output for use with logarithmic chart paper. A high value and the number of decades must be entered. The low value is defined by the other two settings. For example, a high value of 1000 FTU with 3 decades would give a range of 1–10–100–1000 FTU

Low Value (signal level)

Select 4 mA or 0 mA as the low value of the output signal.

0/4 mA (scaling limit)

Enter the measurement value that will correspond to 4 mA (or 0 mA).

Whenever the measurement is equal to this number, the output signal will be set to its minimum value. Whenever the measurement is less to this number it will be set to 0 mA or 3.8 mA when 4 mA has been selected (NAMUR NE43).

If the output scaling type is auto-range, the low value is always zero.

Note: Output signals can be "inverted" by setting the minimum value higher than the maximum.

Mid (Bi-linear scaling only)

Enter the measurement value that will correspond to the middle of the range (10 or 12 mA).

20 mA (scaling limit)

Enter the measurement value that will correspond to 20 mA.

Whenever the measurement is equal to this number, the output signal will be set to its maximum value. Whenever the measurement is greater than this number it will be set to 20.5 mA (NAMUR NE43).

Num of Decades (logarithmic scaling only)

Select the number of decades for the scale, from 1 to 6 (e.g., 1 to 100 is two decades).

On failure 22 mA

If the system or measurement fails, the system can failsafe to either 22 mA or not. In the case that the failsafe is set to off, the output will go to 20.5 mA. . This state is displayed as asterisks "*****" on the front panel display.

Current Out

Displays the actual current (mA) being outputted.

SET HOLD MODE

The Set HOLD Mode menu is used to configure the HOLD state of the transmitter. During configuration and wash intervals, the transmitter can remain in the HOLD state for reasons of safety. The output currents are frozen (at last value or at a preset fixed value, depending on the configuration), limit and alarm relays are set to their non-activated status. If a meter is on hold, this is indicated by a flashing “H” on the display.

HOLD state:

No HOLD: The transmitter is never set to a HOLD state. It is always in a live state.

CAUTION: this setting can lead to unintentional switching of alarm/ and limit relays as well as to unexpected mA output readings when configuring the transmitter.

Fix: The current outputs (1-4) are frozen to a defined value when the transmitter goes into the HOLD state.

Fix Value: Enter the mA output value for the HOLD state.

Last: The current outputs are frozen to the last value as soon as the transmitter goes into the HOLD state.

NOTE: The transmitter is also set into the HOLD state if the corresponding discrete input is activated (see chapter 2, Discrete Inputs). If “No HOLD” has been selected in the software menu, mA-outputs are only frozen at their last value when the digital input activates the HOLD.

FILTER

Filtering stabilizes measurement readings in applications with noisy signals. The following options are available: “none” or “Low Pass” Filter.

RELAYS MENU

The Relays Menu is used to define measurement limits, alarm conditions, a wash interval and length. All relays are SPDT (Single Pole Double Throw) types.

CAUTION: The default software settings for the relays, and the descriptions of the relay operations below, assume that the relays are wired in the following manner (see Chapter 2):

Limit 1 to TB6 pins 8 and 9 (normally open)

Limit 2 to TB6 pins 11 and 12 (normally open)

Alarm to TB5 pins 1 and 2 (normally closed)

Wash to TB5 pins 5 and 6 (normally open)

When the measurement value is higher than a high limit value or lower than a low limit value, an alarm condition exists. Limit alarm conditions are indicated by a flashing measurement reading when in the display mode. Also, the corresponding relay is closed when a limit value is exceeded.

The Alarm relay is opened in case of a system or power failure.

NOTE: Setpoints are defined for a specific Parameter Set. The active Parameter Set is displayed in the Relay menus .

Select Relay

Use the «' » and « ` » arrow key to select a Relay (Limit 1 or 2, Alarm or Wash), then press «**Page Down**» to continue with the set-up for that relay. Complete all set-up parameters for one relay before starting another.

To set-up the next relay, press «**Page Up**» until you return to the initial relay screen and then select another relay.

LIMIT 1 AND 2

Value

Enter the desired setpoint value in the measuring units displayed.

Delay

A time delay requires the limit value to be exceeded continuously for a specified length of time before activating the relay. Enter the delay time in seconds.

If the condition disappears before the delay period is over, the relay will not be activated.

Hysteresis

A hysteresis value requires the measurement to return within the limit value by a specified percentage before the relay is deactivated.

For a high setpoint, the measurement must decrease more than the indicated percentage below the limit value before the relay is deactivated. With a low setpoint, the measurement must rise at least this percentage above the limit value before the relay is deactivated. For example, a high setpoint is set at 100 and the measurement is currently above this value so that the setpoint is exceeded and the relay is activated. If the hysteresis value is 10%, then the measurement must fall below 90 before the relay is deactivated.

Enter a percentage value. No greater than 50%.

Set Point

Select high or low. Select Off to disable the Set Point and to avoid relay triggering.

State

The **State** setting allows the operator to decide whether the relay will be physically activated or not during normal operation. If the N.O. state is selected then the relay contacts will be open when the limit is not exceeded or when the power is off (relay deactivated). The relay contacts will close when the limit is exceeded (relay activated). This is the default setting. If the N.C. state is selected then the relay contacts will be open when the limit is exceeded and when power is off (relay deactivated). The relay contacts will be closed when the measurement is within the limits (relay activated). This assumes that the contacts are wired as described at the start of the relay section.

ALARM

The alarm relay is activated in case of system or power failure.

Delay

A time delay requires the alarm state to exist continuously for a specified length of time before activating the relay. Enter the delay time in seconds.

If the alarm condition disappears before the delay period is over, the relay will not be activated.

State

The State for the Alarm relay can not be changed. The relay will always be activated and the contact is open when there is no alarm. The relay contact will close when there is an alarm or when the power fails or is shut off.

Use alarm if mA outputs are under-/over-range

If **one** of the defined measuring ranges (see Chapter 4, mA Output #) is exceeded, the Alarm relay can be activated. Select yes or no.

WASH

The Wash relay is used to activate an appropriate cleaning device for the sensor.

Interval

Enter the time between two wash cycles in hours. The smallest possible value is 0.010 hr (36 seconds). The greatest possible value is 999.9 hours. The Wash relay will be activated when the interval time has been counted down. Enter 0.000 hr for deactivating the wash function. Press «Enter».

Depending on HOLD state settings, the instrument will go into the HOLD state when a wash cycle has been started (see chapter 3, HOLD state).

Wash time

Enter the time which is needed for a washing cycle in seconds. The greatest possible value is 600 seconds. Press «Enter». The wash relay will be activated for the length defined here plus a fixed post delay time of 20 seconds. After this time the instrument will leave the HOLD state - if activated.

State

The **State** setting allows the operator to decide whether the relay will be physically activated or not during normal operation. If the N.O. state is selected then the relay contacts will be open when the wash is off or when the power is off (relay deactivated). The relay contacts will close when wash starts (relay activated). This is the default setting. If the N.C. state is selected then the relay contacts will be open when the wash is on or when power is off (relay deactivated). The relay contacts will be closed when the wash is off (relay activated). This assumes that the contacts are wired as described at the start of the relay section.

SAVE/RECALL MENU

In the previous sections all settings for a certain application have been defined in one Parameter Set (P-Set A through C) and have been automatically saved.

In this menu you can copy the current settings to another Parameter Set or you can recall another Parameter Set, i.e. when the application changes.

Another Parameter Set can be recalled in the following menus or by using the corresponding discrete input (see Chapter 2, other connections).

Select

Select Save if you want to copy the current settings of a Parameter Set to another one. This is helpful if you want to duplicate your current settings as an initial state for another Parameter Set. Select Recall if you want to activate a certain Parameter Set. Press **«Page Down»**.

P-Set

Select the Parameter Set you want to save or recall. Press **«Enter»**.

RESET MENU

The Reset Menu is used to clear user programming and return settings to their default values; for the entire system, for single Parameter Sets, or Calibration settings of the active Parameter Set.

Use the **«' »** and **« ` »** arrow keys to select the desired option to reset, then press **«Enter»**. The available options are: **“System“**, **“P-Set“**, and **“Cal“**.

System

A system reset will:

- Clear and disable all relays, setpoints, and mA outputs in all P-Sets
- Clear all Calibration Settings in all P-Sets.
- Set the serial port to 38.4K baud and even parity. The data output is turned off.

It will not change the unit number.

Press **Page Down** to reset the system.

P-Set

A P-Set reset will:

- Clear and disable all relays, setpoints, and mA outputs in the active P-Set
- Clear all Calibration Settings in the active P-Set.
- Set the serial port to 38.4K baud and even parity. The data output is turned off.

Cal

A Cal reset will clear all calibration settings of the active P-Set.

Press **«Page Down»** to rest calibration settings of the active P-Set.

SECURITY MENU

The Security Menu is used to prevent unauthorized changing of parameters. Users can be locked out of all menu functions, locked out of calibration only, or locked out of all menus except calibration. Without the correct numeric password, the user will only be able to view the menus.

A master password is required to change any passwords, lockout options, or to enable/disable the security program. Two user passwords can be defined.

The initial master and user passwords are set to a default of 00000.

Go to ...

Use the «' » and «`» arrow keys to select the desired security option, then press «Enter». The available options are: Change Lockout, Change Password, Lockout Status and Lost Passwords.

To select another option after completing any of these options, press «Page Up» to return to this screen and select.

Change Lockout

Enter the master password to change any of the security lockout options.

Lockout

If lockout is enabled, users must enter their password to gain access to the menus. If disabled, no passwords will be required.

User 1

Select the desired lockout for User 1. The available lockout options are: “Lockout All”, “Lock Cal Only”, and “Open Cal Only”.

User 2

Select the desired lockout for User 2.

Change Password

Use to change any of the passwords.

Which password to change

Select the desired user or master password.

Master Pass

Enter the master password to proceed.

New password

Enter a new 5 character password and press «Enter». You will then be prompted to re-enter the password to confirm it.

Lockout Status

The status fields are for display only.

Lockout is

Displays whether security lockout is disabled or enabled.

User 1

Displays current lockout option for User 1.

User 2

Displays current lockout option for User 2.

Time since last access in menus

Displays the elapsed time since the menus were last accessed by any user.

DIAGNOSTICS MENU

During measurements there are diagnostic testing routines running in the background of the transmitter software in order to alarm the user in case of any system failure.

In addition, there is a Diagnostic Menu used to run a series of diagnostic testing routines to verify the operation of the system components, including: transmitter, sensor, mA outputs, serial port, display, keypad, inputs and relays.

Use the «' » and «`» arrow keys to select a component to test, then press «Enter». The indicated test will be performed and the results displayed. Press «Enter» to perform the next test.

To test another component, press «Page Up» to return to the Diagnostic Menu and select the next component.

After completing the desired diagnostics, press «Menu (exit)» twice to exit the menu system and return to display mode.

CAUTION: Some diagnostic tests may interrupt normal operation of current outputs and relays and could upset related processes.

See the appropriate section below for information regarding the specific diagnostic tests.

Sensor

Light source: The LED light intensity is measured via a reference diode placed close to the LED. This test does not include testing of the fiber optic cable or the sensor.

Self Tests

An automated series of tests will check the operation of the following components:

- Sensor
- Current outputs
- Discrete Inputs
- Display circuit board
- Measurement circuit board
- Relay circuit board
- Other components (ROM, RAM, etc.)

The display shows how many times the tests have run, the elapsed time and the number of errors found. Press «**Menu (exit)**» to stop the test sequence.

Relays

Use this option to test triggering of all four relays simultaneously. (Limit 1, Limit 2, Alarm, Wash).

Inputs

The level of the discrete input lines (high or low) will be displayed and updated (for P-Sets A through C and HOLD input).

Serial Port

Use a jumper wire to connect TB2 terminals 9 and 10 then press «**Enter**» to begin the serial port test.

Meter Test

Use to test the timers, ROM checksum, and RAM. Tests are performed sequentially, press «**Enter**» to perform next test.

Keypad

Press any key to test its response, the correct name of the key should be displayed. Press «**Menu (exit)**» twice to exit this test.

Display

An automated sequence will test the display of all characters (alpha, numeric and symbol). Press «**Enter**» to stop the test.

mA Output

Connect an amperometer to the mA output. Select an output to test, then enter a current value (milliamps) to send out the current output, then press **Page Down** to set. Repeat the test with a second current value to verify range response.

LANGUAGE MENU

Select the language in which the menu and online Help texts are displayed. You can choose between “**English**”, “**German**” and “**French**”. Press «**Enter**» to confirm.

OTHER MENUS

The Other Menu is used to access less commonly used features, including:

- Set Time/Date
- Set Unit Name
- Lost Passwords
- RS232 Set-up
- Print Configuration
- Software Revisions
- Service Only

Set Date/Time

Use to enter the correct date and time. Note that the internal clock does not run when power is off. It is only a convenience for setting the dates of calibration.

Time

Enter time in hours, minutes and seconds (hh:mm:ss).

Date

Enter date in month, day and year format (mm/dd/yy).

Set Unit Name

This feature is especially useful when more than one unit is used. Enter the name or location of this unit (up to 20 characters).

The unit name is displayed whenever exiting menus and appears in configuration printouts.

Lost Passwords

To recover lost passwords, record the codes displayed on the screen and then call the METTLER TOLEDO Customer Service for assistance (phone +41 1 736 2525).

RS232 set-up

The RS232 Menu is used to format the data output communication parameters (baud, parity, etc.).

For detailed digital communications with regards to Main Program Software Upgrades see Chapter 7.

Data output: Selected to on, the current measurement with a time stamp can be recorded via the RS232 using a printer or a communication software package on a PC when this becomes available.

Print Configuration

A computer or printer can be used to record all set-up information (P-Sets A through C). If a device is connected to the RS232 output, press «**Enter**» to print. If the RS-232 output is connected to a computer, then a program like Hyper Terminal can read all of the set-up information.

Software Revs

Displays the engineering revision numbers of the currently installed system circuit boards (main, measurement, display option).

Service Only

These are service password protected functions for use by METTLER TOLEDO Service Personnel only.

CHAPTER 5: CALIBRATIONS

INTRODUCTION

The METTLER TOLEDO turbidity system consisting of a Trb 8300 transmitter, an InPro8000 sensor and a possible extension cable takes advantage of fiber optic technology. Consequently, sensors of the InPro8000 series provide a wide linear measuring range and the backscattered light technology enables a sensor design with uniform, unbroken surface structure.

The use of different lengths of fiber optic cable results in different characteristics of light emitted into and scattered back from a liquid sample. Therefore a turbidity calibration is always a system calibration including the transmitter, the InPro8000 series sensor with 3 or 6 m fix cable, and extension cable if needed. Any modification of an existing system, i.e. installation of an additional fiber kit extension or exchanging the sensor requires a new system calibration.

Therefore the Trb 8300 provides an advanced calibration philosophy in order to combine advantageous fiber optic sensor technology with user friendly transmitter operation.

CALIBRATION TYPES

Three different types of turbidity calibration are possible. The first type is called **Manual Calibration**. This type is the fastest and lowest level of calibration. The user can change the offset and the slope, and a measuring value is calculated and displayed.

The second type of calibration is called **Multipoint Calibration**. This type of calibration achieves the best linearity for the process being measured. The routine can calibrate from 2 to 5 points starting from the highest turbidity reading and going down. After completing a Multi Point Calibration, if the user reenters the menu again and performs another Multi Point Calibration, the original calibration factors are erased.

The third type of calibration is called **Process Calibration**. This type of calibration is an online calibration, where the user enters the Process Cal menu and saves the current turbidity reading. At this point, the user takes a “grab sample” of the process to measure it against a laboratory instrument to get a reference turbidity measurement. At the same time, the transmitter returns to display the measurement and functions normally. Upon returning to the online transmitter, the user re-enters the Process Calibration menu. The next step allows the user to enter the reference turbidity value that was obtained in a lab. Also showed is the stored value that the transmitter saved during the initial entry into Process Calibration. Note that the current reading may be very different than the stored value due to the time that has elapsed while obtaining the laboratory measurement. Finishing the menu entries completes the Process Calibration.

A user will most likely go into a Process Calibration after a Multipoint or Manual Calibration to fine tune the process.

Caution: For each type of calibration, you need to refer to Chapter 3 of the InPro8000 Series Sensor manual to make sure you are handling the sensor correctly during the various calibrations. A clearance of at least 10 cm from sensor tip to any type of surface is required to avoid erroneous readings. For calibrations in beakers, it is highly recommended to use the METTLER TOLEDO CaliCap sensor calibration tool (part number 52 800 210).

CALIBRATION MENU

Select Manual, Process or Multipoint Calibration and confirm with Enter.

Manual Calibration

Caution: if in the active Parameter Set a Multipoint Calibration has been performed before, you will loose all Multipoint Calibration data irrevocably. You will see a corresponding warning if you are currently using a Multipoint Calibration and try to enter the Manual Calibration menu.

Manual Calibration requires the following two parameters to be set: OFFSET and SLOPE. The parameter OFFSET shifts the zero point of measurement and assigns it to a specific signal value. The SLOPE parameter sets the slope of a straight line representing a linear turbidity measurement. This determines the sensitivity of measurement.

Manual Calibration is required i.e. to determine a suitable measuring range for media with unknown turbidity characteristics. In this case the sensor is dipped into a clear medium – representing the zero point of the system - and the OFFSET value has to be adjusted until the measuring value reaches zero. Then the sensor is dipped into a turbid media. Now the SLOPE has to be adjusted until the turbidity reaches a value which shall correspond to the turbidity of the turbid media.

Offset

Dip the sensor into the clear media and observe the measurement value displayed in the first line of the menu. To adjust a reading of zero, subtract the displayed measuring value from the current OFFSET value. Type in this number by using the numeric keys or move the cursor to a certain digit and use Up/Down arrow keys to make your adjustment. Press «Enter» and the displayed measuring value is zero, i.e. 0 %.

Slope

Make sure the sensor is in the turbid media. Change the slope value until the desired measuring value is obtained, i.e. 80 %.

Note: when you press «Enter» you will notice that the offset value is changed by the same factor as the slope. This is a result of the used algorithm. The reading of clear media is still zero with the automatically adjusted offset value.

Upon completion of the Manual Calibration go back to the measuring mode to use the new calibration data.

Multipoint calibration

The Multipoint Calibration option is intended to be used for offline calibrations, i.e. in beakers. Make sure the sensor is uninstalled. If HOLD mode is activated, the transmitter will go into HOLD when entering the Multipoint Calibration menu.

A Multipoint Calibration is performed when you are using samples with known turbidity or suspended particle concentration, i.e. when turbidity standards like Formazin are used or the concentration of the samples has been determined by a reference measurement.

Due to different light scattering characteristics of different samples it is not possible to predict when a Multipoint calibration with more than two points is necessary. Three or more point calibrations can become necessary with samples showing a very high optical density or when you experience a divergence from linear signal output.

A Multipoint Calibration is reasonably performed in the concentration range you are going to measure in your process.

The recommended way to perform a Multipoint Calibration is with samples prepared by defined dilution of a stock solution. This has the advantage that only the concentration value of the stock solution has to be determined by a reference method. The concentration of the other samples results from the defined dilution.

For example: half the volume of a stock solution with 10 g/l suspended solids is diluted with the same volume of clear solvent to get a concentration of 5 g/l. Half of the volume of this 5 g/l solution is diluted by the same volume of clear solvent to get a concentration of 2.5 g/l. The following four point calibration is performed with 10, 5, 2.5 and 0 g/l.

Typically, 200-500 ml of stock solution are necessary to perform an offline calibration, depending on the volume of the beakers in use.

Note: During dilution and measurement make sure you are working with homogeneous samples. Sedimentation of particles has to be avoided by stirring or shaking the solution.

Type

Select 2, 3, 4 or 5 point depending on how many different samples you are going to use. Press «Page Down» to continue.

Cal Point

Dip the sensor into the sample with the **highest concentration** first. In the second line of the display you will see the current reading. Enter the known measured value of your sample and press «Page Down». A message shows up indicating that calibration is in progress.

Rinse the sensor with clear solvent and proceed to calibrate the second point with the second highest concentration.

Typically the last point of a Multipoint Calibration is performed with the clear solvent.

Upon completion of the Multipoint calibration the transmitter goes back to the measuring mode automatically using the new calibration data.

Re-install the sensor again in your process to use the linearized measuring curve.

You can stop a Multipoint Calibration at any time by pressing the «**Menu (exit)**» button. You must perform a calibration of some type after this !

Process calibration

Process Calibration is intended to be used for inline calibrations. It is applicable after both, Manual Calibration and Multipoint Calibration to update the calibration data when measuring against a grab sample value.

Typically use of Process Calibration:

- use of additional fiber kit if the Multipoint or Manual Calibration was performed with 3 m fixed sensor cable only. In the process, you are using longer fiber optic cable.
- The zero point of the process liquid is not comparable with the clear solvent you used for offline calibrations due to different solvent qualities.
- The sensor is replaced by a new one.

Having started a Process Calibration you are being asked to press «**Page Down**» to save the current reading. This should happen at the same time that you take the grab sample from the process.

The transmitter goes back to the measurement mode reminding the user that a Process Calibration has been started by a flashing "Process Cal" in the last display line.

When you know the concentration of the grab sample, enter the Process Calibration Menu a second time: quick access can be done by pressing «**Page Down**» when the instrument is in the measuring mode.

Adjust: Choose **Slope** or **Offset** depending on whether the measuring curve shall be adapted to the grab sample value by changing the offset or the slope value of the curve. Press «**Page Down**» to continue.

Note: It is recommended to choose Offset if the grab sample value is close or equal to zero. A repeated Process Calibration is possible if you experience that an earlier change of slope or offset has not resulted in the desired measurements.

When additional fiber optic extension cable is used, perform a Process Calibration at higher concentrations and select slope adjustment.

Value then Page-down to cal: Enter the known value of your grab sample and press «**Page Down**». The instrument performs the Process Calibration and goes back to the measuring mode.

A Process Calibration can be stopped without changes by pressing «**Menu (exit)**» when you have entered the Process Calibration Menu the second time.

TYPICAL APPLICATIONS

The following sections provide proposals for calibrating the measuring system in different applications.

Crystallization

This is a typical application to monitor the concentration increase of particles (crystals) in a process liquid. Crystallization of a solid product can be started by cooling down the process media or by dosing an appropriate reagent to start the precipitation. In most cases the concentration of the undissolved particles is not known. Consequently **the Manual Calibration** routine is the method of choice.

Select % as units in the Parameter Set Menu, indicating that you are measuring on a relative scale.

The sensor is installed directly in the reactor. Before the crystallization starts you will have a clear media. Adjust the offset in the Manual Calibration menu to get a measurement of 0%. Adjust the slope value somewhere between 500 and 1000 and go back to the measuring mode.

As soon as the crystallization starts the measuring value is going up. If you need higher sensitivity to detect the very beginning of the crystallization you can increase the slope value.

If you want to monitor the process at even higher concentrations, you can define another Parameter Set with a slope value which is smaller by a factor of 5-10. Additionally, you can use a second mA-output for data transfer.

When the measuring range of the first Parameter Set is exceeded, you switch to the second Parameter Set by recalling it in the corresponding menu or by using the remote function of the corresponding digital input.

Fermentation

Provided that you have a cell culture with known cell concentration, you can use the **Multipoint Calibration** routine. Select an appropriate measuring unit for the currently used in Parameter Set, i.e. g/l or % depending on your reference method of determining the cell concentration.

Note: a turbidity system cannot distinguish between dead and live cells.

Prepare defined concentrations of your stock cell-culture by defined dilution with clear nutrient solution. Perform the Multipoint Calibration.

When the sensor is installed in the fermenter you can fine-tune your calibration by using the **Process Calibration** routine:

- Adjustment of the zero point if only clear nutrient is filled into the vessel. Enter Process Calibration twice and select adjustment of offset to make the instrument read zero. You can also use this routine to minimize the influence of oxygen bubbles by turning on the aeration during Process Calibration.
- Adjust the current reading by taking a grab sample during the fermentation. Choose adjustment of slope at higher cell concentrations.

Suspended solids in waste water

In this application you can use the **Manual Calibration** routine for zero point adjustment followed by a **Process Calibration**.

Select an appropriate measuring unit for the currently used Parameter Set, typically g/l.

Dip the sensor into a beaker with clear water and adjust the offset value in the **Manual Calibration** menu to get a reading of zero.

Install the sensor in your process pipe or channel. Take a grab sample and perform a Process Calibration to adjust the current reading to the value determined later in the laboratory. Choose slope adjustment in the Process Calibration routine.

Calibration with Turbidity Standards

Formazin is a typical liquid standard for turbidity measurements. Values are expressed in FTU, NTU or EBC.

Calibration with standards is always an offline calibration with samples of known turbidity. Consequently a Multipoint Calibration is the right technique to use.

Select FTU, NTU or EBC in the Parameter Set menu.

Prepare different concentrations from your Formazin stock solution and perform a **Multipoint Calibration**.

After installing the sensor back into your process you can use your Formazin calibration to show turbidity values on the Formazin scale.

Solids/Liquid separation process

The system can also be used to monitor the performance of a solids/liquid separation process. Typically, filters or separators (centrifuges) are used for this application. The quality of the liquid phase is measured behind the filter/centrifuge.

Caution: The detection limit of InPro8200 sensors is 5 NTU = 5 FTU = 1.25 EBC. The detection limit of InPro8050 and InPro8100 is 10 NTU = 10 FTU = 2.5 EBC. Do not use the measuring system if your filtrate quality requires a turbidity value lower than these values.

If the sensor is installed in the filtrate line, use **Manual Calibration** to get a reading of zero by entering an appropriate offset value when the filter/centrifuge is working properly. Enter an appropriate slope value. In case of a breakthrough of particles the transmitter can be used to give an alarm.

Depending on the type of process it can be necessary to work with higher or lower sensitivity in case of a particle breakthrough. Adjust the slope value in the Manual Calibration menu accordingly.

Dry calibrations with Calicap

CaliCap is a METTLER TOLEDO sensor calibration tool (part number 52 800 210). Using CaliCap is highly recommended for offline calibrations in liquid samples in order to avoid disturbing reflections from beaker surfaces.

Furthermore you can use CaliCap to perform a system check without solutions (dry check). CaliCap calibrations are always offline calibrations. The sensor needs to be uninstalled.

Note: If you are not using a dedicated Parameter Set for CaliCap 2-point dry checks, note the current calibration settings of the Parameter Set in use in order to restore them when you install the sensor in the process again. Be aware that a previous Multipoint Calibration will be lost when you start a Manual Calibration in the same Parameter Set. To avoid this, recall another Parameter Set you are currently not using for measurements in liquids.

Select units % in the Parameter Set menu and go back to the Measure Mode. According to the CaliCap manual you start with a high “turbidity” value. Enter a slope value in the **Manual Calibration** menu to adjust a reading of 100 %. For the zero point adjustment follow the instructions in the CaliCap manual and adjust the offset value until the transmitter reads zero.

Note the new settings for offset and slope. You can use these values to check system performance with CaliCap at a later date.

If possible you can use an unoccupied Parameter Set to save your calibration data with CaliCap and recall this Parameter Set for routine checks of the system with CaliCap.

CHAPTER 6: MAINTENANCE & TROUBLESHOOTING

MAINTENANCE

For Technical Support and repair information contact your local METTLER TOLEDO dealer

Front Panel Cleaning

Clean the front panel with a damp soft cloth (water only, no solvents). Gently wipe the surface and dry with a soft cloth.

TROUBLESHOOTING CHECKLIST

If the equipment is used in a manner not specified by METTLER TOLEDO, the protection provided by the equipment may be impaired.

Review the table below for possible causes of common problems:

Problem	Possible Cause
Display is blank.	No power to Trb 8300. Blown fuse. LCD display contrast set incorrectly. Hardware failure.
Display shows "Check Lamp"	No sensor connected to the transmitter. Blown LED.
Display shows "Cannot Calibrate"	Calibration solution used in wrong order.
Display shows flashing "H"	Transmitter is currently in HOLD mode
Display shows flashing "Process Cal"	A Process Cal has been started.
Display shows *****	Calibration settings not suitable for current media
Incorrect measurement readings.	Loose sensor connections on meter backpanel. Sensor fouling or coating. System needs calibration. System configuration during calibration was different than the current system configuration (other sensor, additional Fiber Kit extension, etc.) Hardware failure. Current turbidity values are below detection limit of used sensor.
Measurement readings not stable.	Loose sensor connections on transmitter backpanel. Maximum cable length exceeded (170 m). Low Pass filter off. Gas bubbles in process media. Process Pipes not filled completely. Sensor tip too close to beaker walls (< 10 cm). CaliCap is not used for offline calibrations.
Displayed measurement reading is flashing.	Limit value is in alarm condition (Limit value exceeded).
Cannot change menu settings.	User locked out for security reasons.
Data not sent out to serial port.	Serial port miswired. Baud rate and/or parity set incorrectly.

CHAPTER 7: UPGRADE

UPGRADES

There is software for various functions located in the Trb 8300. The need for field upgrade is likely to occur only with the Main Program and Measurement software.

Main program Software Upgrade

Over the life of the instrument, it may become desirable to upgrade the main operating software of the Trb 8300 to a newer version. The main operating software revision number can be displayed by stepping through the menus: Other Menus/Software Revs/Main Program.

The main program software is changed by downloading the new operating file using METTLER TOLEDO Thornton utility program Max95.exe. It runs on computers

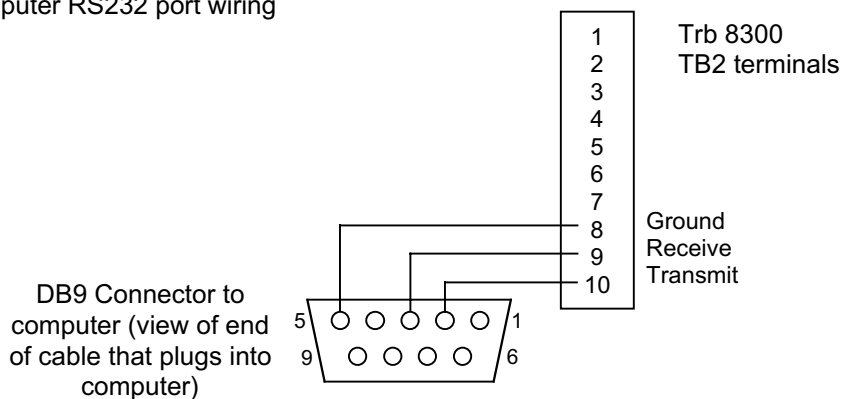
using Windows95 or later and occupies about 0.7 MB of hard disk space.

NOTE: Not all menus of the Max95 program are functional—use only those needed for the upgrade as described in the procedure below.

A cable is required with connector for the computer's RS232 port. Most computers use a DB9 connector as shown. Tinned leads at the other end connect to the Trb 8300 screw terminals.

Because the memory chip containing operating software also contains extensive instrument calibration data, it is not practical to upgrade software by replacing the memory chip.

Trb 8300 to computer RS232 port wiring



Procedure

1. Record all the configuration settings and the serial number of the Trb 8300 unit being upgraded.
2. Confirm that the Trb 8300 is configured for communications. Press «**Menu (exit)**» and use «' » in Other Menus to display "RS232 Set-up". Set Baud = 38.4K, Par = Even, Data Output = Off, if they are not already set this way.
3. Connect the Trb 8300 to the computer RS232 port as shown above.
4. From e-mail or floppy disk, copy the program Max95.exe and the new Trb 8300 software file e.g. 43714_14 into a convenient folder or desktop of the computer.
5. Run Max95.exe by double clicking it in Windows Explorer and ignore any small incidental windows that may open.
6. Click to open 'Communication' menu and 'RS-232 Functions' and select 'Gateway Port Set-up'.
7. Select Port—COM 1 (or other port if you are using another).
8. Select Baud Rate—38400.
9. Select Data Bits—8.
10. Select Parity—Even.
11. Uncheck Enable Polling. Leave other settings as found (Flow Control—Xon/Xoff, Stop Bits—1).
12. Click OK and observe 'Connected' in the lower border of the window when communications are functioning.

13. Click on the integrated circuit button (Program Unit, 4th from right) on the tool bar.
14. Select Units to Program—One Unit and enter 0 in the box. Leave Unit Type at Main.
15. Click 'Read' and locate the new Trb 8300 software file and click OK. The new software version will be loaded into computer memory.
16. Click 'Program'. Loading to the Trb 8300 will take several minutes. Allow to run until 100% is displayed.
17. Restore the serial number of the unit using the appropriate command in section RS232 Communications.
18. Disconnect the RS-232 wiring from the Trb 8300.
19. If necessary, reconfigure the unit with the settings recorded in step 1.

CHAPTER 8: ACCESSORIES AND SPARE PARTS

ACCESSORIES

Description	Part Number
IP65 field type enclosure for wall mounting incl. 3 pcs. PG11, 2 pcs PG13.5 cable glands Dimensions: H: 175 mm, W: 205 mm, L: 260 mm (H: 6.89", W: 8.07", L: 10.24") Material: coated aluminum	52 800 864
RS232 interface cable 2m (6 ft.)	58 080 111
CaliCap (offline calibration tool)	52 800 210

SPARE/REPLACEMENT PARTS

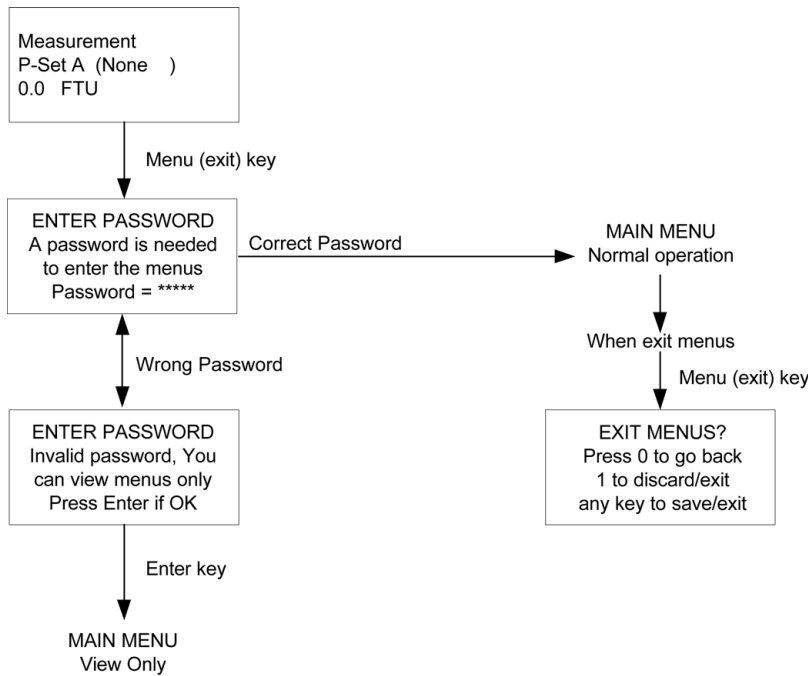
Description	Part Number
10-Terminal plug-in connector (TB2 and TB3)	52 800 251*
6-Terminal plug-in connector (TB5 and TB6)	52 800 252*
Fuse, 0.5 A slow blow, 5 x 20 mm (Littlefuse 215.500 or equivalent)	52 800 253*
Panel mounting screws (6-32 x 7/16", 4 required)	52 800 254
Screws for front panel (2 required)	52 800 255
Retaining washers for front panel (2 required)	52 800 256
Liquid crystal display module (order mounting standoffs separately)	52 800 257
Display standoffs (4 required for display above)	52 800 258

*Recommended Spare parts

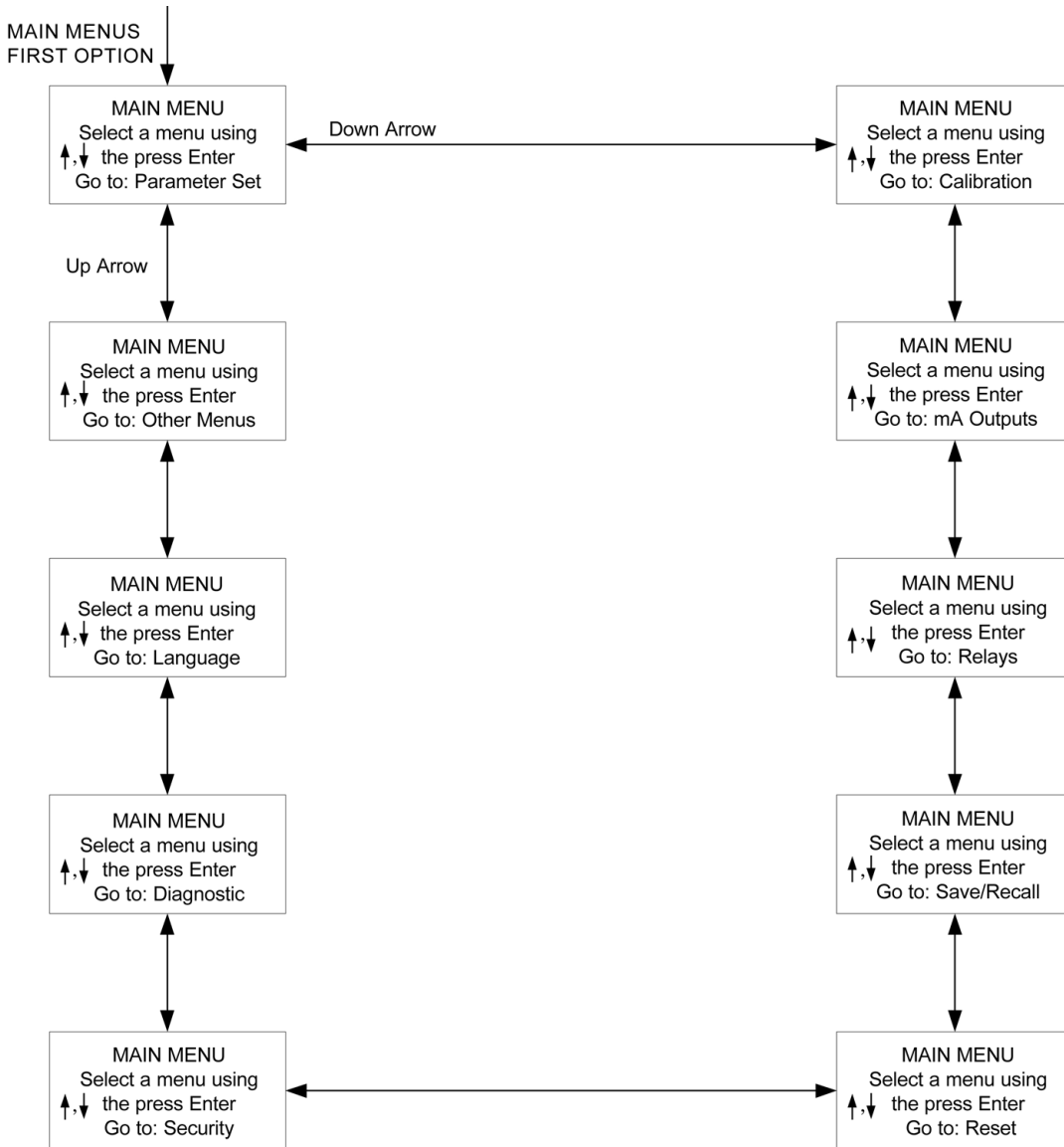
APPENDIX A: MENU TREES

The following menu trees illustrate the general sequence of settings available in the Trb 8300.

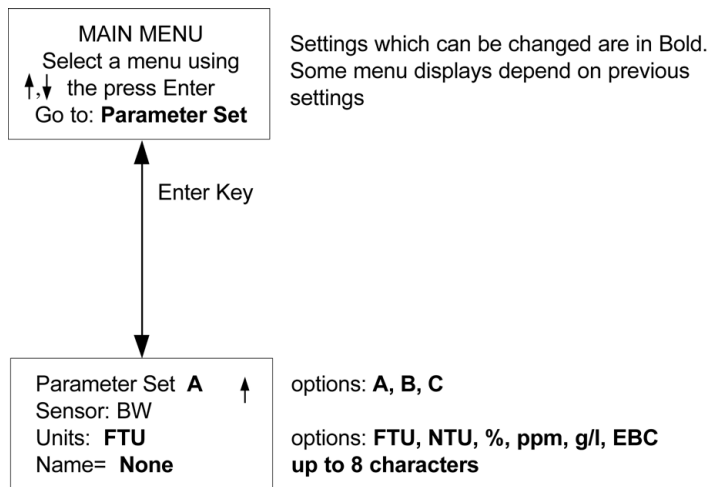
The screens below will appear after pressing «Menu» only if security has been enabled. Otherwise pressing «Menu» accesses the Main Menu directly, as shown on the following pages.



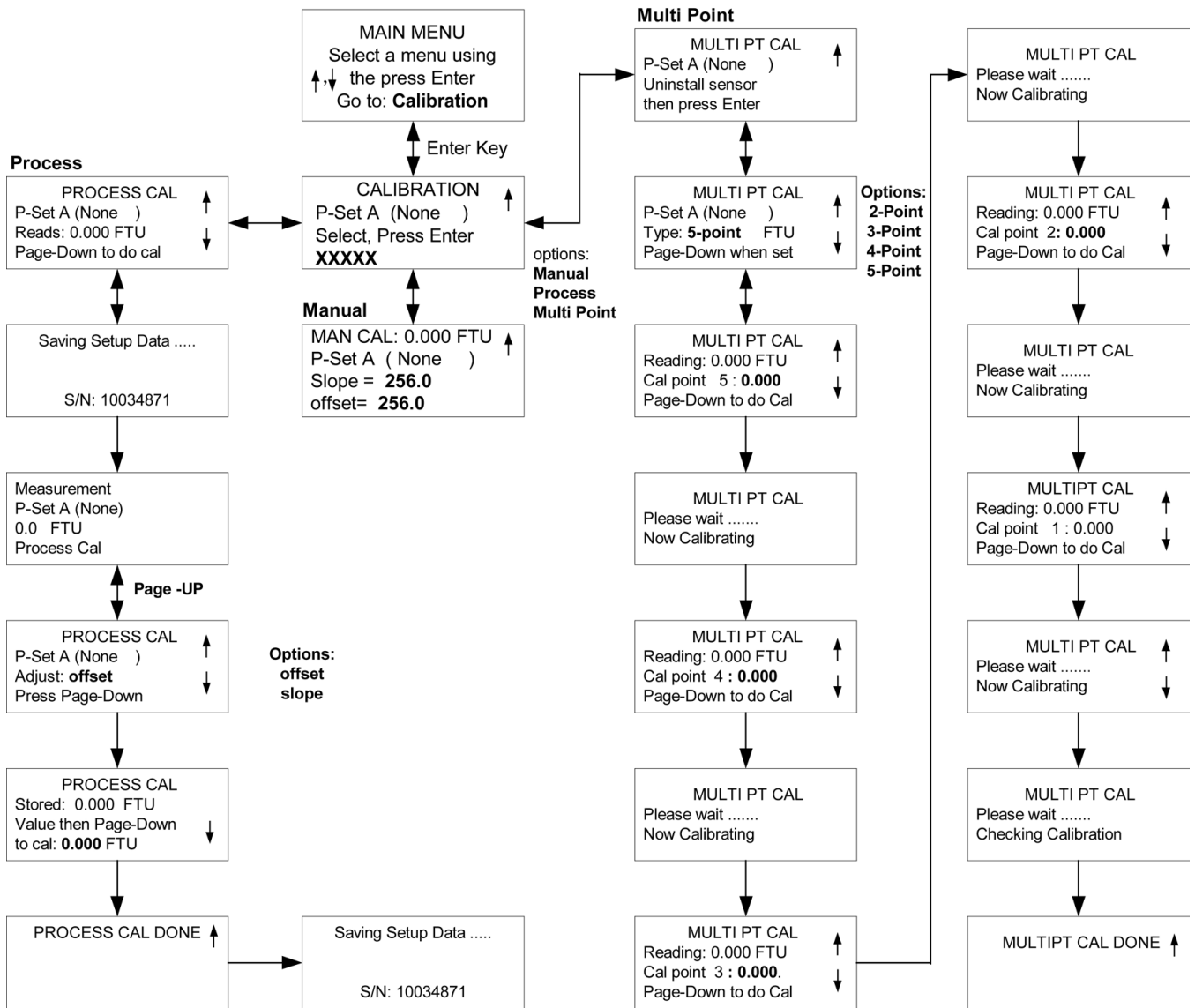
MAIN MENUS



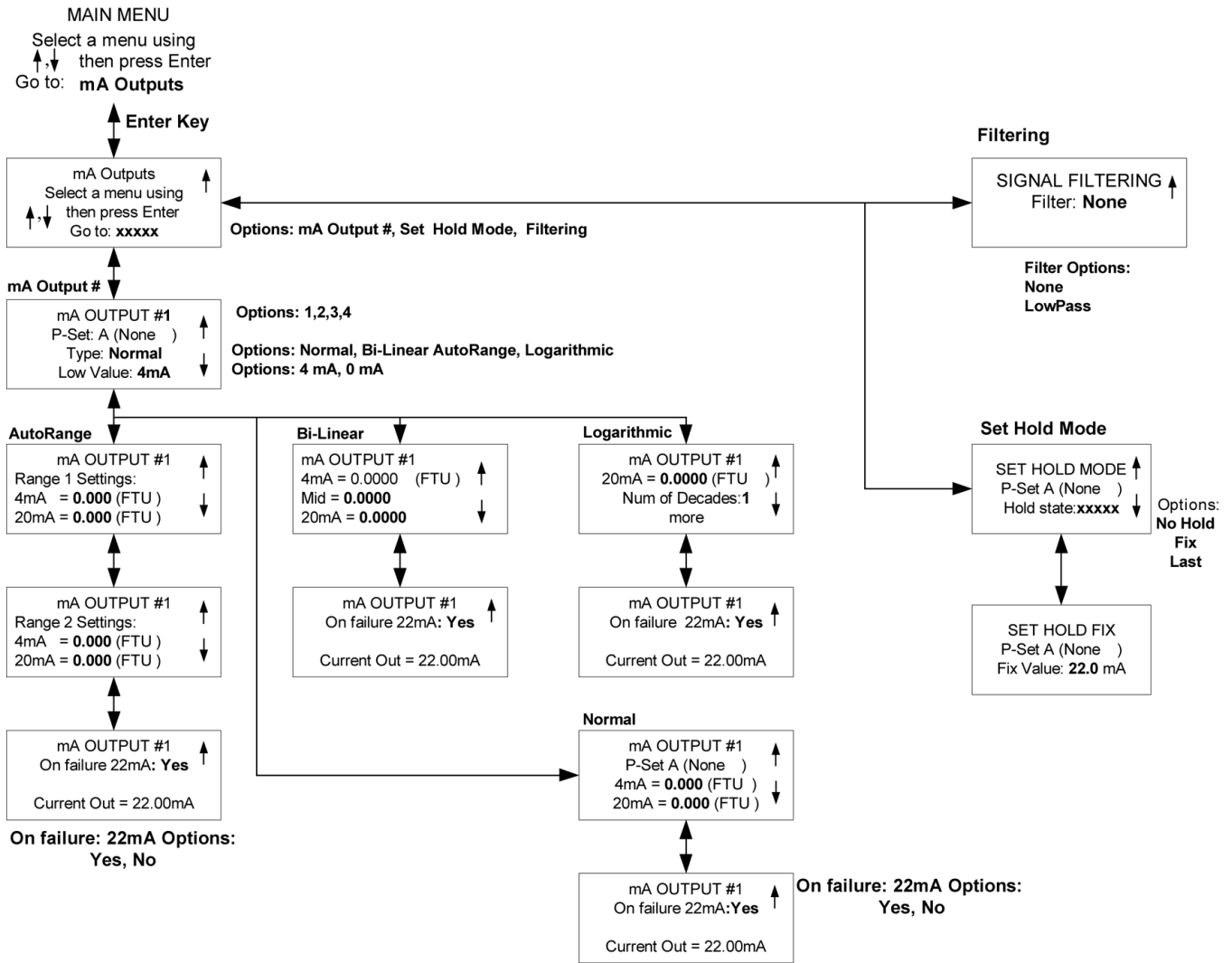
PARAMETER SET MENU



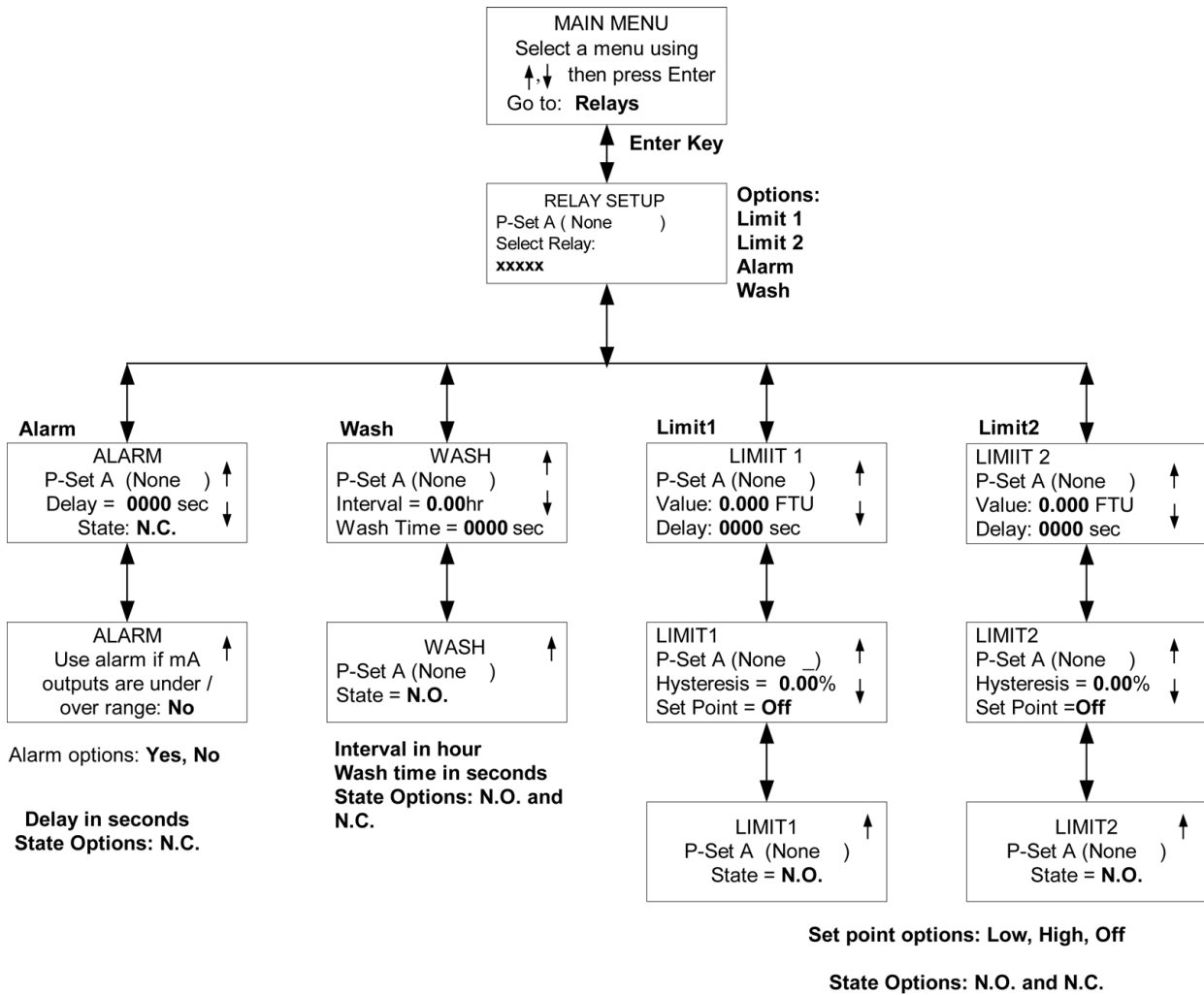
CALIBRATION MENUS



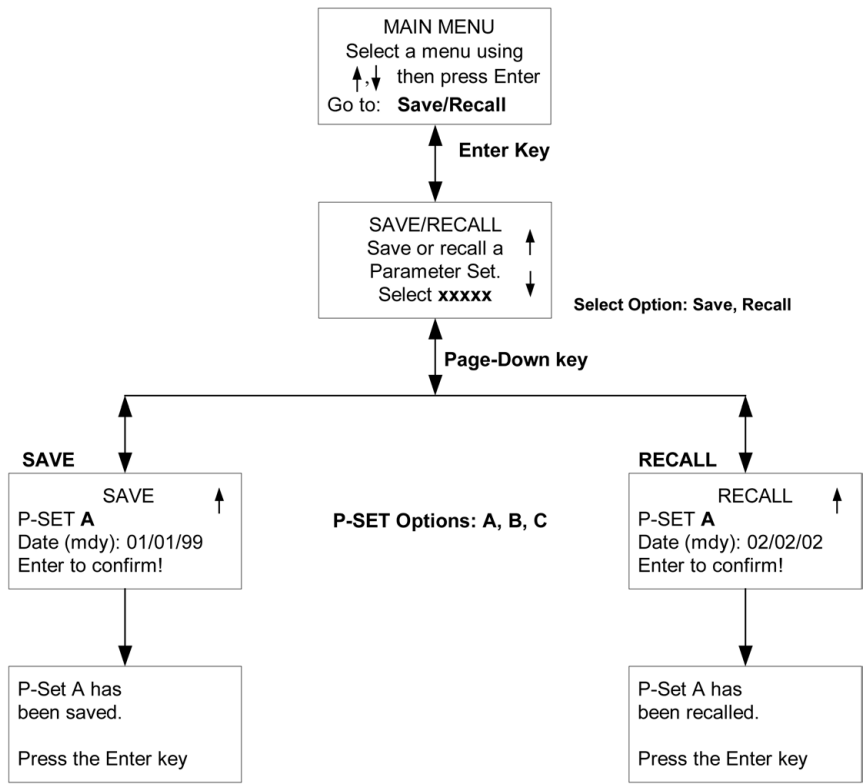
mA OUTPUTS MENUS



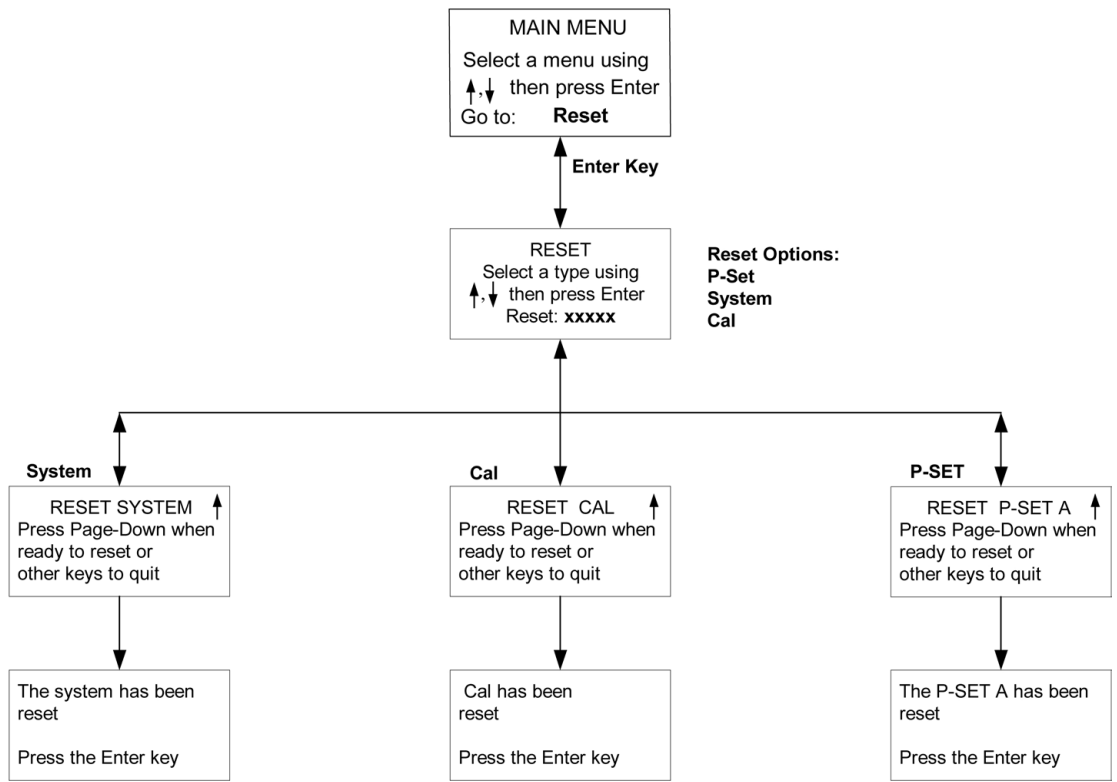
RELAYS MENUS



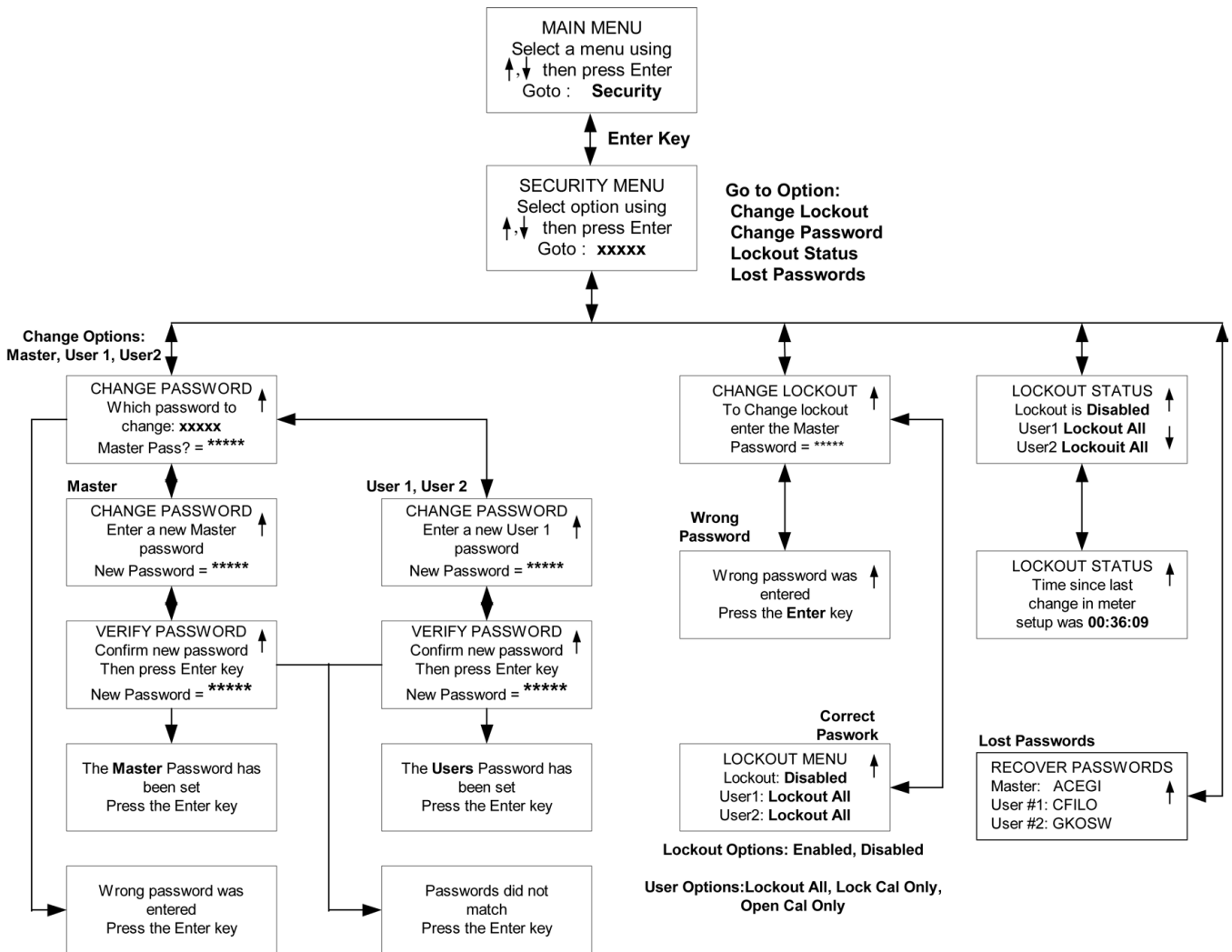
SAVE/RECALL MENUS



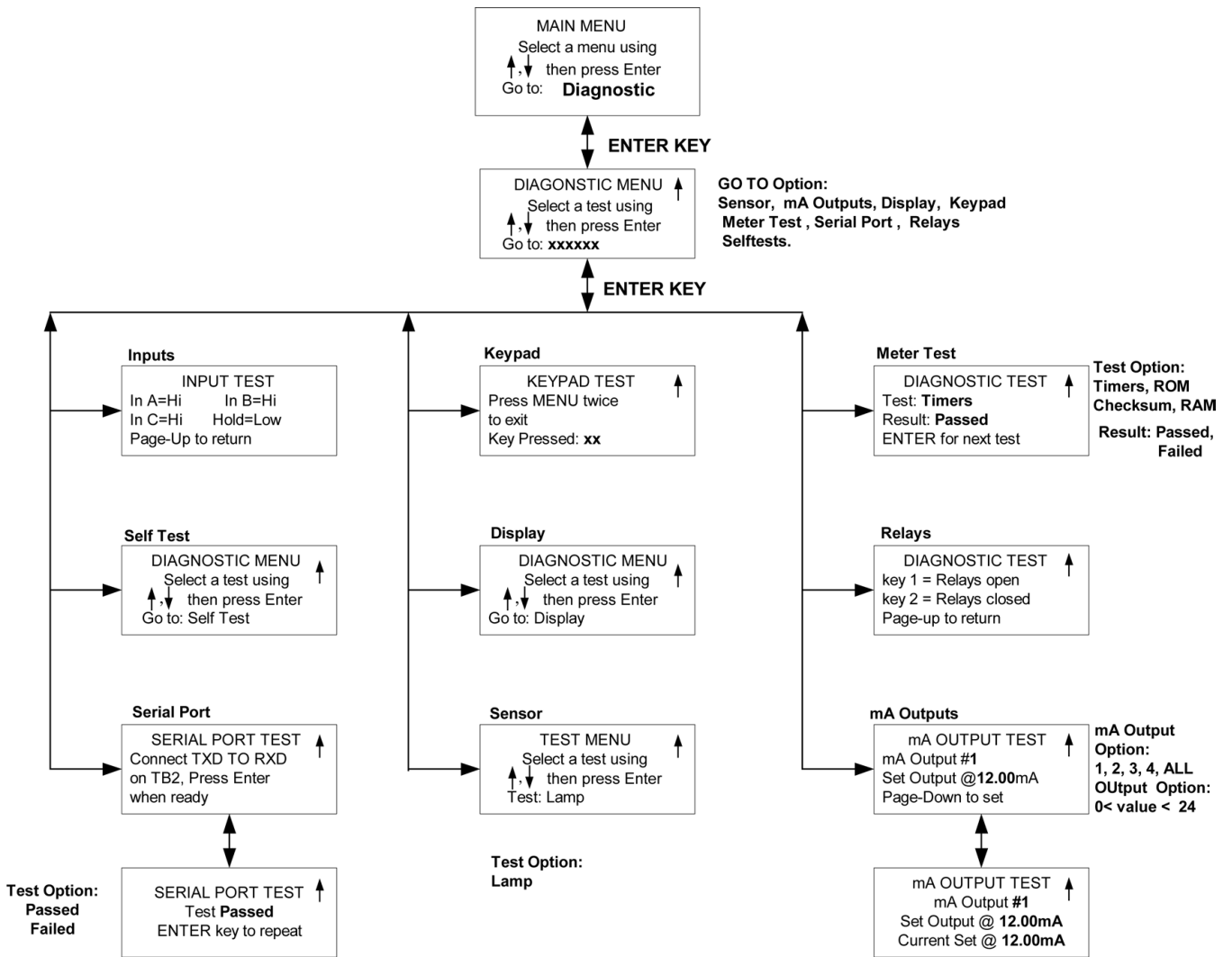
RESET MENUS



SECURITY MENUS

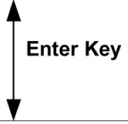


DIAGNOSTICS MENUS



LANGUAGE MENUS

MAIN MENU
Select a menu using
↑,↓ then press Enter
Go to: **Language**

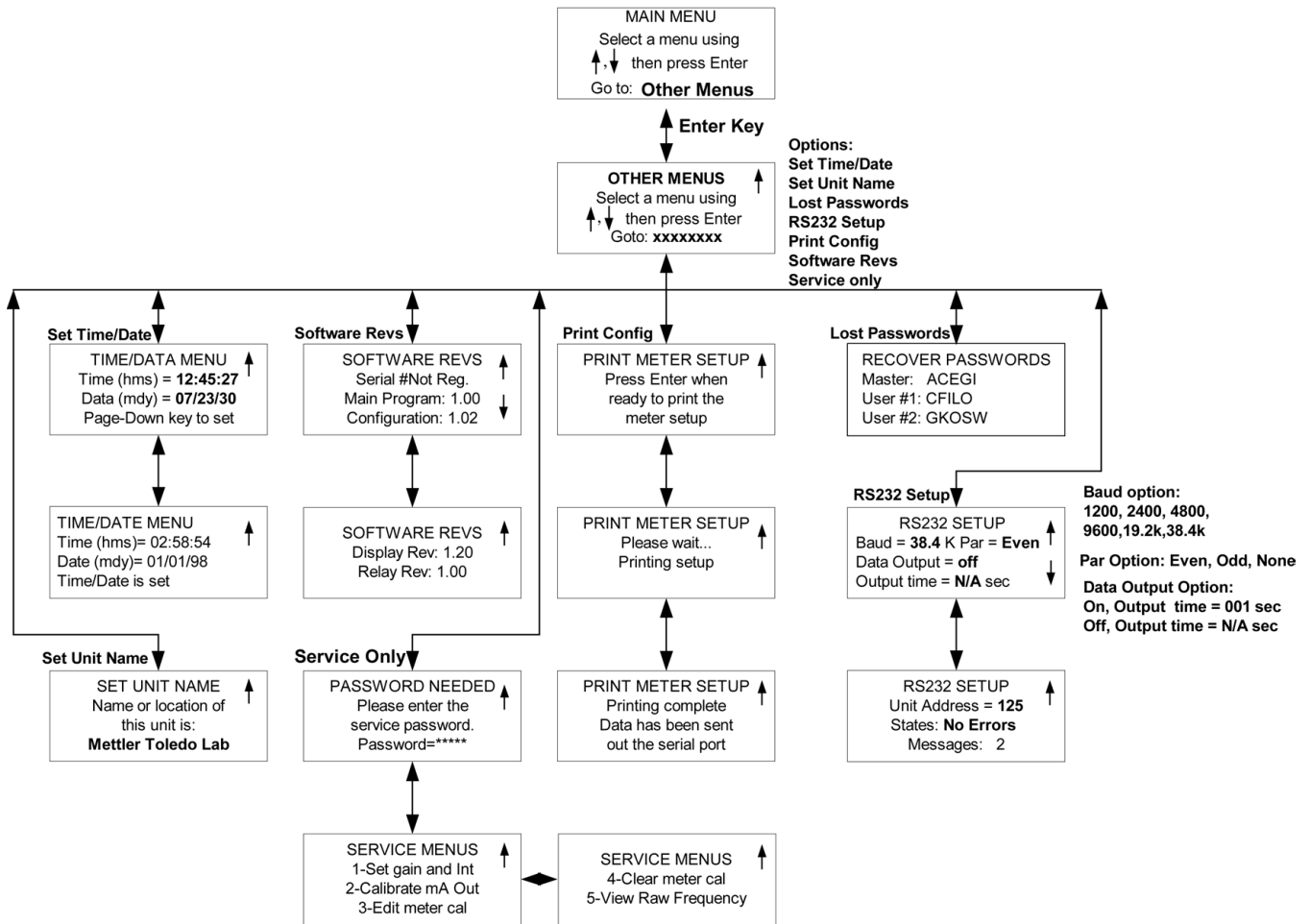


LANGUAGE
Select language use
↑,↓ then press Enter
Language **English**

Language Option:

- English**
- German**
- French**

OTHER MENUS



APPENDIX B: SET-UP PARAMETER RECORD

MEASUREMENT PARAMETERS RECORD 1/2

Photocopy this form for each Parameter Set programmed into the Trb 8300.

Unit Name: _____ **Date:** _____

Sensor installed:

Model: _____ S/N: _____

Fiber Kit extension length: _____ P/N: _____

Parameter Set: _____

Units: _____ Name: _____

Calibration routine: _____ Slope: _____

Offset: _____

Analog Output 1

Output Type: _____ Range: _____

On failure set output to 22 mA: _____

Analog Output 2

Output Type: _____ Range: _____

On failure set output to 22 mA: _____

Analog Output 3

Output Type: _____ Range: _____

On failure set output to 22 mA: _____

Analog Output 4

Output Type: _____ Range: _____

On failure set output to 22 mA: _____

Filter: _____ **HOLD mode:** _____

Limit Value 1:

Value: _____ Delay: _____

Hysteresis: _____ Setpoint : _____

State: _____

Limit Value 2

Value: _____ Delay: _____

Hysteresis: _____ Setpoint : _____

State: _____

MEASUREMENT PARAMETERS RECORD 2/2

Wash contact:

Interval: _____ Wash time: _____

State: _____

Alarm:

Delay: _____ State: _____

Use alarm if mA outputs are under/over range: _____

Passwords

Master: _____ User1: _____

User2: _____

Language: _____

RS232 Settings

Baud: _____ Parity: _____

Data output: _____ Output time: _____

Unit adress: _____

APPENDIX C: SPECIFICATIONS

Power supply	100-240VAC 25 Watts maximum, 47-63 Hz (part number 52 800 204) 20...32 VDC 25 Watts maximum (part number 52 800 906) On power loss, all stored values are retained in non-volatile memory without batteries. Clock does not run when power is off.
Light source	Light-emitting diode (LED), emitting frequency 880 nm, installed in transmitter
Measurement	Input/output for InPro8000 fiber optic sensor, backscattered light principle
Measurement range	5 FTU...4000 FTU (Formazin Turbidity Units) and 0...30 g/l suspended solids with InPro 8200 10 FTU...4000 FTU and 0...250 g/l suspended solids with InPro 8050 and InPro 8100
Selectable measuring units	FTU NTU EBC g/l % ppm
Digital Input	4 buffered digital inputs (0-5 V) – 1 digital input to HOLD the output (i.e. the 4-20 mA outputs are held or set to predefined values until the HOLD signal is removed). – 3 digital inputs to select one of three Parameter Sets A through C (memorized)
Parameter Sets	Three different Parameter Sets (A through C) can be stored in memory and recalled by software menu or remote access via digital inputs
System Calibration (Operating modes)	
Manual Calibration (user input)	Offset and gain values for the sensor can be entered directly
Process Calibration	Single-point grab-sample calibration (offset or slope: user selectable)
Multipoint Calibration	2, 3, 4 or 5 point automatic calibration (offset and gain) for linearization of measurement values
Default calibration	On reset default calibration factors are loaded into the transmitter
Security	Password-protected menu access for different user levels (master, user 1 and 2)
Sensor diagnostics	Light Source (internal reference signal = 0)

Output 1-4	Four standard powered 0/4-20 mA outputs, 500 ohm load maximum, isolated from the measurement circuitry ; accuracy ± 0.05 mA, typical. Outputs are assignable to any Parameter Set with free scaling in linear, bi-linear, logarithmic or auto range format.
Alarm contact	Relay contact, mechanical SPDT, floating
Contact ratings	AC < 250 V / < 5 A DC < 30 V / < 5A
Contact response	N/C (fail-safe type)
Alarm delay	000...600 s
Wash contact	Relay contact, mechanical SPDT, floating
Contact ratings	AC < 250 V / < 5 A DC < 30 V / < 5A
Contact response	N/O or N/C
Rinsing interval	0.0 ... 999.9 h (0.0 h = cleaning function switched off)
Cleaning time	000...600 s
Limit values (2)	2 relay contacts, mechanical SPDT, floating
Contact ratings	AC < 250 V / < 5 A DC < 30 V / < 5A
Contact response	N/O or N/C
Delay	000...600 s
Switching points	hi-hi / hi-lo / lo-lo
Hysteresis	0.0...50.0%
Digital Communications	For main program software updates and print outs of configurations
RS232 standard	max. distance 15 m (45 ft)
Baud rate	1200, 2400, 4800, 9600, 19.2k and 38.4k
Parity	odd, even or none
Display	LC display, 20 character x 4 line, backlit
Keypad	20 tactile feedback keys
Language	software selectable: English, German, or French for menu and help texts
Diagnostic functions	Sensor mA outputs Display Keypad Meter Serial Port Relays Selftest

Data retention	Parameters and calibration data in non-volatile memory without batteries
CE	
Emissions	EN 55011 Group I, Class A ISM emissions.
Immunity	EN 61000-6-2 EMC heavy industrial generic immunity standard.
Safety	IEC 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use
US UL	3111-1 Electrical Measuring and Test Equipment
CAN / CSA	C22.2, No. 1010.1
Nominal operating conditions	
Ambient temperature	-10...+50 °C (14 ... 104 °F)
Transport/Storage temp	-20...+80 °C (-4 ... 176 °F)
Relative humidity	0...80 % up to 31 °C (88 °F), decreasing linearly to 50 % at 40°C (104 °F)
Altitude	2000m (6500 ft.)
Enclosure	
Alloy	ABS-PC, UV and chemically resistant
Assembly	Panel mounting, cutout 96 x 96 mm (3.78" x 3.78") 1/4 DIN
Dimensions	H 125 mm, W 114 mm, L 162 mm (H 4.92", W 4.50, L 6.39")
Rating	front panel seal, rating pending
Weight Approx.	0.9 kg (2 lbs.)

APPENDIX D: RATINGS



Declaration of Conformity

We,

Declare under our sole responsibility that the product:

Trb 8300 Transmitter

to which this declaration relates, is in conformity with the following European, harmonized and published standards at the date of this declaration:

Emissions:	EN 55011	Group I, Class A ISM emissions.
Immunity:	EN 61000-6-2	EMC heavy industrial generic immunity standard.
Safety:	IEC 61010-1	"Safety requirements for electrical equipment for measurement, control and laboratory use" incorporating Amendments Nos. 1 & 2.

Testing for compliance was carried out to the following specifications:

Following the provisions of the directives 89/336/EEC Electromagnetic Compatibility

Amendment to the above directive: 93/68/EEC

Low Voltage. Directive 73/23/EEC

Amendment to the above directive: 93/68/EEC

UL Recognition

Mettler- Toledo Thornton, Inc., 36 Middlesex Turnpike, Bedford, MA 01730, USA has obtained Underwriters Laboratories' Recognition for Trb 8300 Transmitters. They bear the cULUS recognition mark, signifying that the products have been evaluated to the applicable ANSI/UL and CSA Standards for use in the U.S. and Canada.

US UL	3111-1 Electrical Measuring and Test Equipment
CAN/CSA	C22.2, No. 1010.1

APPENDIX E: WARRANTY

METTLER TOLEDO guarantees the quality of materials and workmanship within a narrow range of manufacturing tolerances, so that the product purchased is free from any substantial deviations from material and manufacturing quality standards. The warranty is valid for the period of one year from date of delivery ex works. If within this warranty period, any repair or replacement should become necessary, and such cause is not due to misuse or incorrect application, please return the product, carriage paid, to your appropriate METTLER TOLEDO agency. Repair work will be carried out free of charge. Final decision on whether the defect is due to a manufacturing error or to incorrect operation of the product by the customer is made at the option of the Customer Service department of METTLER TOLEDO. After expiry of the period of warranty, faulty products will be repaired or replaced on an exchange basis against payment of the costs involved.

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