Preface

This manual is intended for technicians involved in the commissioning and troubleshooting of the Honeywell Enraf 977 Tank Side Indicator. A description preceding the technical procedures gives the technical information necessary to understand its operation. It is recommended to read this description prior to performing any of the procedures.

For installation of the 977 Tank Side Indicator and the installation and commissioning of the connected level gauge, refer to the installation guides and instruction manuals of the related gauges. This manual describes the display settings of the 854 XTG servo gauge and 970/971/973 SmartRadar, and the communication error codes of the 977 Tank Side Indicator. For an overview, refer to the list of related documents in Appendix C.

Legal aspects

The commissioning of and troubleshooting to the instrument may only be conducted by qualified engineers, trained by Honeywell Enraf and with knowledge of safety regulations for working in hazardous areas.

The information in this manual is the copyright property of Enraf BV, Netherlands. Enraf BV disclaims any responsibility for personal injury or damage to equipment caused by:

- Deviation from any of the prescribed procedures;
- Execution of activities that are not prescribed;
- Neglect of the general safety precautions for handling tools and use of electricity.

EC declaration of conformity

Refer to the EC declaration of conformity, shipped with the instrument.

About this manual

In this manual, the differences in the newer Tank Side Indicator firmware (A3.0 and higher) are described. The main differences with the previous firmware version are:

- Tank Side Indicator displays default display format (set by item DF in the gauge)
- Pin code for keyboard commands (item 0B in the gauge) is deleted
- Only four gauge commands can be selected by the keyboard

Additional information

Please do not hesitate to contact Honeywell Enraf or its representative if you require any additional information.
# Table of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>3</td>
</tr>
<tr>
<td>1 Introduction</td>
<td>5</td>
</tr>
<tr>
<td>1.1 Functional description</td>
<td>5</td>
</tr>
<tr>
<td>1.2 Operating principle</td>
<td>5</td>
</tr>
<tr>
<td>2 Safety</td>
<td>6</td>
</tr>
<tr>
<td>2.1 Safety aspects of the 977 Tank Side Indicator</td>
<td>6</td>
</tr>
<tr>
<td>2.2 Personal safety</td>
<td>6</td>
</tr>
<tr>
<td>2.3 Safety conventions</td>
<td>6</td>
</tr>
<tr>
<td>3 Commissioning</td>
<td>7</td>
</tr>
<tr>
<td>3.1 Display settings</td>
<td>7</td>
</tr>
<tr>
<td>3.2 Pincode for keyboard commands</td>
<td>7</td>
</tr>
<tr>
<td>3.3 Adjustment of display contrast</td>
<td>8</td>
</tr>
<tr>
<td>3.4 Communication time-out selection</td>
<td>8</td>
</tr>
<tr>
<td>4 Operation</td>
<td>9</td>
</tr>
<tr>
<td>4.1 Display</td>
<td>9</td>
</tr>
<tr>
<td>4.2 Scrolling through display formats</td>
<td>9</td>
</tr>
<tr>
<td>4.3 Gauge commands for 854 ATG / XTG</td>
<td>10</td>
</tr>
<tr>
<td>5 Troubleshooting</td>
<td>11</td>
</tr>
<tr>
<td>Appendix A</td>
<td>12</td>
</tr>
<tr>
<td>Display formats servo gauges</td>
<td>12</td>
</tr>
<tr>
<td>Appendix B</td>
<td>17</td>
</tr>
<tr>
<td>Display formats SmartRadar LT</td>
<td>17</td>
</tr>
<tr>
<td>Appendix C</td>
<td>19</td>
</tr>
<tr>
<td>Related documents</td>
<td>19</td>
</tr>
<tr>
<td>Index</td>
<td>20</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Functional description

The 977 Tank Side Indicator (TSI) is designed to display the level, temperature or other gauge data from the Honeywell Enraf series 854 servo gauges or the 970/971/973 SmartRadar.

Note:
The Tank Side Indicator can only be connected to the servo gauge if the servo gauge is equipped with the XPU-2 board with the i.s. option (XPU-2/i.s.).
The Tank Side Indicator can only be connected to the 970 or 971 or 973 SmartRadar if the radar gauge is equipped with the i.s. output option for 977 TSI (ICU_IS2 board).

The LCD display of the 977 Tank Side Indicator has two 16-characters lines. Incase of the 854 XTG Servo gauge and 970/971/973 SmartRadar, which have no display, the TSI provides the display function.

The 977 Tank Side Indicator can be installed at ground level or in any other convenient place in the vicinity of the tank, provided the distance to the level gauge is not more than 250 metres (820 ft).

Only one cable (2 cores) is required for the electrical connection of the 977 TSI. The supply for the 977 TSI is provided by the level gauge and is intrinsically safe (EEx - ib). The data transmission for the 977 TSI is superimposed on the supply lines (FSK based on the Bell 202 modem standard).

This manual gives information on:
- Items to be set in the level gauge for the different display functions of the 977 TSI (854 XTG and 970/971/973 SmartRadar only)
- Diagnostic information on the Tank Side indicator and on the level gauges
- Display functions of the 854 ATG / XTG and 970/971/973 SmartRadar

1.2 Operating principle

For firmware version previous A3.0:
The 977 Tank Side Indicator continuously asks the level gauge for items 1A (upper display row display format A) and 2A (lower display row display format A).

For firmware version A3.0 and higher:
After power up and the initial message, the 977 Tank Side Indicator request for display format (item DF) of the level gauge. With that information, the 977 TSI continuously asks the level gauge for the selected display format (upper and lower display row).

The refresh rate is approximately once per second. An “alive” indication is given in the last character on the upper display row of the Tank Side Indicator by a blinking (on/off) “underscore” (_).

If the communication between the Tank Side Indicator and the level gauge fails for more than 5 or 15 seconds (the interval time is adjustable), the display information on the 977 TSI is removed and replaced by diagnostic information about the communication error.

With the optional keyboard consisting of four membrane keys, the different display formats of the level gauge can be selected and, for servo gauges, gauges commands can be given.
2 Safety

2.1 Safety aspects of the 977 Tank Side Indicator

*Warning*
Do not use the instrument for anything else than its intended purpose.

The housing of the 977 Tank Side Indicator is dust-tight and protected against water jets.
The 977 Tank Side Indicator is supplied by the level gauge and is certified as intrinsically safe:

- II 2 G Ex ib IIB T4 Gb; according to KEMA 03ATEX1467, certified by KEMA Netherlands
- Ex ib IIB T4 Gb, acc IECEx KEM 10.0069, certified by KEMA Netherlands
- Class I, Division 1, Groups C and D T4; Job Identification No. 3004639, by Factory Mutual, USA.

2.2 Personal safety

The technician must have basic technical skills to be able to safely commission the equipment. When the 977 Tank Side Indicator is installed in a hazardous area, the technician must work in accordance with (local) requirements for electrical equipment in hazardous areas.

*Warning*
In hazardous areas it is compulsory to use personal protection and safety gear such as:
- hard hat, fire-resistive overall, safety shoes, safety glasses and working gloves.

Avoid possible generation of static electricity. Use non-sparking tools and explosion-proof testers.
- Do not open the cover of the instrument while power is still connected.

Make sure no dangerous quantities of combustible gas mixtures are present in the working area.

Never start working before the work permit has been signed by all parties.

2.3 Safety conventions

"Warnings", "Cautions", and "Notes" have been used throughout this manual to bring special matters to the immediate attention of the reader.

- A **Warning** concerns danger to the safety of the technician or user;
- A **Caution** draws attention to an action which may damage the equipment;
- A **Note** points out a statement deserving more emphasis than the general text, but not requiring a "Warning" or a "Caution".
3 Commissioning

The commissioning of the display items for the 854 XTG or 970/971/973 SmartRadar, to which the Tank Side Indicator is connected, shall be performed after the basic settings have been given to the gauge.

3.1 Display settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>W2=</td>
<td>Protection level 2</td>
<td>Enter protection level 2</td>
</tr>
<tr>
<td>DF=</td>
<td>Display format</td>
<td>One character, A ... K. Selects the required display format for the 977 TSI. Refer to section 4.1 for an overview of all available display formats.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A : recommended for servo / radar level gauges with optional temperature measurement;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B : recommended for servo / radar level gauges without temperature measurement.</td>
</tr>
<tr>
<td>DG=</td>
<td>Tenth millimetre selection</td>
<td>One character. Only valid when level dimension is metres.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y : for tenth millimetre indication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N : for millimetre indication</td>
</tr>
<tr>
<td>DJ=</td>
<td>Zero format</td>
<td>One character. Selects how the number zero is displayed:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 : as an “0” with “slash”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>O : as capital letter “O”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Default is the zero with slash.</td>
</tr>
<tr>
<td>EX</td>
<td>Exit</td>
<td>Exit protection level 2.</td>
</tr>
</tbody>
</table>

3.2 Pincode for keyboard commands

Only valid with 977 TSI firmware <A3.0.

When the 977 Tank Side Indicator is equipped with the optional keyboard, a pincode must be specified in the servo gauge. The chosen pincode is to be issued from the indicator keyboard before the command is executed.

The indicator keyboard has four keys with arrows: ‘left’, ‘down’, ‘up’ and ‘right’. In figure 3.1 these keys are marked as: L (left), D (down), U (up) and R (right). With the keys: L, D and U a “pincode” can be formed of maximum eight characters long. A practical approach is to select a pincode of 2 or 3 characters.

For instance:
“L D U ” (left arrow key, down arrow key and up arrow key). This pincode must be programmed in item 0B of the servo gauge.

When the Tank Side Indicator displays the message: “Pincode= “, the keys: arrow left (L), arrow down (D), arrow up (U) are to be pressed (the chosen pincode) plus 5 times the key arrow right (R) to complete the eight character long pincode.

**Note 1:**
*This is only valid for the 854 ATG and XTG servo gauges, as the 973 SmartRadar LT does not recognize gauge commands as Test Gauge, Interface Profile, etc.*
Note 2:  
When a pincode is not required, item OB must be programmed with the first eight character being spaces ( ) and the next eight characters being dots (.)?

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>W2=</td>
<td>Protection level 2</td>
<td>Enter protection level 2</td>
</tr>
</tbody>
</table>
| 0B=   | Pincode TSI | Sixteen characters. Only the first 8 characters are used as TSI Pincode; the remaining characters must be filled with dots (.)  
For example:  
Pincode is LDU; enter the characters L, D and U plus 5 times space to complete the 8 characters pincode, and fill up the remaining 8 characters with dots (.). Hence, enter:  
L D U space space space space . . . . . . . .  
When there is no pincode required, enter:  
space space space space space space space space . . . . . . . . |
| EX    | Exit       | Exit protection level 2 |

3.3 Adjustment of display contrast

If required, the contrast of the display can be adjusted. When the cover of the Tank Side Indicator is removed, a potentiometer can be reached through a hole in the chassis plate, on the left hand side of the display (refer to fig. 3.2).

Turning the potentiometer clockwise will increase the display contrast, while turning the potentiometer counter-clockwise decreases the display contrast.

3.4 Communication time-out selection

As a default, the communication time-out is set to 5 seconds. If there appear to be minor communication errors on the 977 TSI communication line, the communication time-out can be increased to 15 seconds.

To select the 15 seconds time-out a solder strap must be made on the main printed circuit board of the TSI. Refer to figure 3.3.

With later versions of the TSI, a strap can be placed. Refer to figure 3.4.
To select the 15 seconds time-out:

For TSI versions with a solder strap:
- Remove the cover from the 977 TSI by loosening the four screws at the corner.
- Remove the connector CN1 (wiring can be left connected)
- Loosen the two screws marked “A” in figure 3.2.
- Lift TSI printed circuit board assembly from the housing, turn over to the right hand side and loosen the PCB ground connection in the housing.
- Take the TSI printed circuit board assembly to a workshop or other safe area for soldering.
- Refer to figure 3.3. Locate the four straps S4 at the solder side of the main PCB (at the top). Short the first strap of S4 by soldering the left pad.
- Return to TSI housing. Connect the PCB ground connection, place the PCB assembly in the housing and secure it with the two screws “A”.
- Place connector CN1 and close the cover.

For TSI versions with a strap block:
- Remove the cover from the 977 TSI by loosening the four screws at the corner.
- Remove the connector CN1 (wiring can be left connected)
- Loosen the two screws marked “A” in figure 3.2.
- Lift TSI printed circuit board assembly from the housing, and locate at the top of the printed circuit board strap block S4 between the connector for the LCD flat cable and the connector for the optional keyboard.
- Remove the jumper from the left position and place it to the most right position as indicated in figure 3.4
- Position the circuit board assembly back into the TSI housing and secure it with the two screws “A”.
- Place connector CN1 and close the cover.

Figure 3.4 Strap setting for communication time-out
4 Operation

4.1 Display

After power up of the gauge, the display of the Tank Side Indicator goes black for approximately 1 second, then blanks for approximately 1 second and black again for approximately 1 second. This is part of the self test upon power on. After the self test the initial screen is shown for approximately 3 seconds:

![TSI rev. A3.0 TK0304 973 00]

The two rows contain the following information:

- Version number of the installed firmware in the 977 Tank Side Indicator
- Identification of the connected level gauge: Tank Identifier (item TI), Device number (part of item SV) and Tank address (item TA)

Without any adjustment, the display of the Tank Side Indicator shows the default display format from the level gauge, set by item DF. This is valid from TSI firmware version A3.0 or higher. For previous firmware versions, the display shows the level and temperature (display format A) from the level gauge.

By operating the keyboard, one can scroll through all other display formats of the level gauge. The display formats are:

<table>
<thead>
<tr>
<th>Display format</th>
<th>Displayed information</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Product level and temperature</td>
</tr>
<tr>
<td>B</td>
<td>Product level and status</td>
</tr>
<tr>
<td>C</td>
<td>Average gas temperature and status</td>
</tr>
<tr>
<td>D</td>
<td>Average product temperature and status</td>
</tr>
<tr>
<td>E</td>
<td>HIMS density</td>
</tr>
<tr>
<td>F</td>
<td>Pressure sensor 1 and status</td>
</tr>
<tr>
<td>H</td>
<td>Pressure sensor 3 and status</td>
</tr>
<tr>
<td>I</td>
<td>Servo density and status</td>
</tr>
<tr>
<td>J</td>
<td>Analog level output and status</td>
</tr>
<tr>
<td>K</td>
<td>Water level and status</td>
</tr>
</tbody>
</table>

For the information on the different display formats, refer to Appendix A (854 ATG / XTG) and Appendix B (970/971/973 SmartRadar).
4.2 Scrolling through display formats

By pressing the arrow down (D) key one can scroll through the display formats A ... K. With the arrow up (U) key scrolling goes from display formats K ... A.

When scrolling, information is displayed which display format is selected for approximately 3 seconds, before the selected display format appears (not available with TSI firmware versions <A3.0).

Returning to the default display format can be done by pressing the arrow left (L) key. Refer to table above for the information on each of the display formats.

When scrolling is stopped, the last selected display format will be shown for approximately 20 seconds, then is returned to the default display format.

4.3 Gauge commands for 854 ATG / XTG

Note:

Only the gauge commands which are enabled by item HC (Host Command mode) are executed.

With TSI firmware version <A3.0:

When pressing the arrow right (R) key, a selection can be made out of 12 gauge commands. Scrolling through the gauge commands is done by the arrow down (D) key or arrow up (U) key, similar as with display scrolling. The gauge commands are (in this order when scrolled by arrow down key):

- Interface 1
- Interface 2
- Interface 3
- Block
- Calibrate
- Dip mode
- Freeze
- Interface Profile
- Lock Test
- Test Gauge
- Tank Profile
- Unlock

When the desired gauge command appears on the display, press the arrow right (R) key. The display prompts you for the pincode. The pincode must be entered, followed by pressing the arrow right (R) key a number of times till the total of 8 keys have been pressed.

For example:

The pincode is arrow left (L) key, arrow down (D) key and arrow up (U) key; press keys: (L), (D), (U), (R), (R), (R) and (R) (eight keys pressed).

After the pincode is accepted, the gauge command is performed (signalled by the OK message) and the Tank Side Indicator returns to the default display.

Note:

With a Tank Side Indicator without a programmed pincode (item OB set to 8 x space + 8 times dot), the gauge command is executed after the arrow right (R) key is pressed.
With TSI firmware version A3.0 and higher:

When pressing the arrow right (R) key, a selection can be made out of 4 gauge commands. Scrolling through the gauge commands is done by the arrow down (D) key or arrow up (U) key, similar as with display scrolling. The gauge commands are (in this order when scrolled by arrow down key):

- Calibrate Gauge
- Lock Test
- Test Gauge
- Unlock

When the desired gauge command appears on the display, press the arrow right (R) key. The gauge command will be executed and the Tank Side Indicator returns to the default display.

**Note:**

*If the default display format is A or B, the execution of a gauge command can directly be observed.*

To leave the gauge command menu without performing a gauge command is done by pressing the arrow left (L) key. Then the Tank Side Indicator returns to the default display format.

When the arrow right (R) key is not pressed while in gauge command menu, the Tank Side Indicator will return to the default display format after approximately 20 seconds.
5 Troubleshooting

With TSI firmware version <A3.0:

If the Tank Side Indicator detects a failure in the communication with the level gauge, one of the following error messages appears on the display:

<table>
<thead>
<tr>
<th>Display</th>
<th>Meaning of error code</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERROR TYPE 01</td>
<td>STX not received</td>
</tr>
<tr>
<td>ERROR TYPE 02</td>
<td>ETX not received</td>
</tr>
<tr>
<td>ERROR TYPE 03</td>
<td>Parity error in received data for 01 item</td>
</tr>
<tr>
<td>ERROR TYPE 04</td>
<td>Parity error in received data for 02 item</td>
</tr>
<tr>
<td>ERROR TYPE 05</td>
<td>Preambles bytes (FFH) not received</td>
</tr>
<tr>
<td>ERROR TYPE 07</td>
<td>Received data does not contain correct item code (i.e. 01 or 02)</td>
</tr>
<tr>
<td>ERROR TYPE 08</td>
<td>BCC error in received data for 01 item</td>
</tr>
<tr>
<td>ERROR TYPE 09</td>
<td>BCC error in received data for 02 item</td>
</tr>
<tr>
<td>ERROR TYPE 10</td>
<td>Item 1A data not being received from gauge</td>
</tr>
<tr>
<td>ERROR TYPE 11</td>
<td>Item 2A data not being received from gauge</td>
</tr>
</tbody>
</table>

If one of these error messages appear, then the following actions can be taken to solve the problem:

- Check cabling between Tank Side Indicator and level gauge
- Reset level gauge (by means of RS command)
- Either replace TSI or XPU-2/i.s. board (with servo gauges) or ICU_IS2 board (with 970/971/973 SmartRadar)

With TSI firmware version A3.0 and higher:

The following internal 977 Tank Side Indicator errors are detected and displayed:

<table>
<thead>
<tr>
<th>Display</th>
<th>Meaning of error and how to solve</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERNAL RAM DEFECT *)</td>
<td>Internal RAM defect; replace PCB assembly</td>
</tr>
<tr>
<td>CODE CORRUPT! *)</td>
<td>EPROM code corrupted; replace EPROM</td>
</tr>
<tr>
<td>STACK CORRUPT!</td>
<td>Switch off and on the supply of the 977 TSI (or from related level gauge); if error still occurs, replace PCB assembly</td>
</tr>
<tr>
<td>LCD DD RAM DEFECT *)</td>
<td>Replace LCD module</td>
</tr>
<tr>
<td>INIT LCD FAILED *)</td>
<td>Replace LCD module</td>
</tr>
</tbody>
</table>

*) Providing the kind of error allows writing the message to the display.

If the Tank Side Indicator detects a failure in the communication with the level gauge, one of the following error messages appears on the display:

<table>
<thead>
<tr>
<th>Display</th>
<th>Meaning of error</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM TIMEOUT ERR *)</td>
<td>Communication timeout expired (5 or 15 sec.)</td>
</tr>
<tr>
<td>UNSUPPORTED FORMAT</td>
<td>Selected display format does not exist in the level gauge</td>
</tr>
<tr>
<td>INVALID RESPONSE LENGTH *)</td>
<td>The message of the level gauge does not correspond to the expected length</td>
</tr>
</tbody>
</table>
**Display**

- **UNKNOWN ITEM ID RECEIVED**
  The message of the level gauge contains an unknown item ID.

- **ERROR EXECUTING ????**
  When a gauge command is executed, but the gauge response message is not as expected (i.e., error message from gauge), this message is displayed, where ???? is replaced by the actual given gauge command, i.e.: CALIBRATE GAUGE, LOCK TEST, etc.

The above error messages will automatically clear when the condition leading to the error disappears.

*) These are typical communication errors. The following actions can be taken to solve the problem:

- Check cabling between Tank Side Indicator and level gauge
- Reset level gauge (by means of RS command)
- Either replace TSI or XPU-2/i.s. board (with servo gauges) or ICU_IS2 board (with 970/971/93 SmartRadar)

If the level gauge detects an error in the communication with the Tank Side Indicator, there will be no reply to the Tank Side Indicator. The communication errors are counted and can be requested by item **0L**.

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0L</td>
<td>Number of TSI errors</td>
<td>Indexed item, 4 elements of 3 bytes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tank Side Indicator communication error counter.</td>
</tr>
<tr>
<td></td>
<td>1st element</td>
<td>number of BCC errors</td>
</tr>
<tr>
<td></td>
<td>2nd element</td>
<td>number of parity errors</td>
</tr>
<tr>
<td></td>
<td>3rd element</td>
<td>number of framing errors</td>
</tr>
<tr>
<td></td>
<td>4th element</td>
<td>number of time-out errors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The maximum count is 999; more errors are not registered</td>
</tr>
</tbody>
</table>
Appendix A  Display formats servo gauges

This appendix gives an overview of the ten different display formats of the 854 ATG / XTG.

Level and temperature display (format A)
Level display (format B)

Average gas temperature display (format C)
Average product temperature (format D)

- **Format:**
  - **Aver. Prod. Temp**
  - Example: +015.36°C

- **Temperature:**
  - °C = valid temperature C
  - °F = valid temperature F

- **Dimension or status:**
  - **TD**:
    - **FL** = general multiple temperature failure
    - **TF** = failure in average product temperature reading
    - **NC** = device not calibrated (MTT only)
    - **OR** = temperature out of range
    - **DR** = exceeding differential temperature range (MTT only)
    - **LR** = level below lowest temperature element
    - **AE** = alternative (lower) element selected
    - **MA** = manual level used
    - **LV** = last valid level used

- **Received level status:**
  - **MA** = manual level used
  - **LV** = last valid level used
  - **LF** = level failure or invalid level reading
  - **LN** = level below minimum required level for HIMS
  - **- -** = valid level used

- **Pressure transmitter status:**
  - **MP** = manual P3 used
  - **LP** = last valid P3 used
  - **- -** = valid P3 used

- **Gas density / pressure status:**
  - **FL** = general HPU/OPU/HSU failure
  - **PF** = failure of P1 or P3
  - **OR** = P1 or P3 out of range
  - **TR** = P1 or P3 exceeds trip pressure
  - **MG** = manual gas density used
  - **- -** = valid density

- **General density status:**
  - **FL** = general HPU/OPU/HSU failure
  - **MD** = manual density
  - **LD** = last valid density
  - **OF** = °API under/overflow or negative density
  - **DH** = density high alarm
  - **DL** = density low alarm
  - **- -** = valid density

HIMS density display (format E)

- **Format:**
  - **Ob. Dens.**
  - Example: 00811.5 kg/m³

- **Dimension DI:**
  - kg/m³ K
  - °API A
  - lbs/cuft L
### Appendix

**Status pressure P1**

- **FL**: general HPU/OPU/HSU failure
- **NI**: pressure transmitter not installed (item PA)
- **PF**: pressure transmitter failure (or absent)
- **OR**: pressure transmitter out of range
- **TR**: pressure transmitter exceeds trip pressure
- **- -**: valid pressure

**Status pressure P3**

- **FL**: general HPU/OPU/HSU failure
- **MP**: manual pressure
- **NI**: pressure transmitter not installed (item PA)
- **LP**: last valid pressure
- **OR**: pressure transmitter out of range
- **TR**: pressure transmitter exceeds trip pressure
- **- -**: valid pressure

**HIMS pressure display (format F and H)**

<table>
<thead>
<tr>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSensor n xx P PPPPPP PPP ppp</td>
<td>+0010.123 kPa</td>
</tr>
<tr>
<td>PSensor 3 MP +0000.123 kPa</td>
<td></td>
</tr>
</tbody>
</table>

**Density measurement type**

- **IP**: interface profile
- **TP**: tank profile

**Density status**

- **FL**: general density failure or no data available
- **OF**: conversion overflow
- **UF**: conversion underflow
- **NM**: no measuring point or out of range
- **NR**: measurement not ready
- **- -**: valid density

**Servo density display (format I)**

<table>
<thead>
<tr>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density aa xx DDDDDDD eeeeee</td>
<td>00843.7 kg/m³</td>
</tr>
</tbody>
</table>

**Observed density**

- **kg/m³**: K
- **°API**: A
- **lbs/cuft**: L
Analog level output display (format J)

Water level display (format K)
Appendix B  Display formats SmartRadar

In appendix B the level display formats (display format A and B) are given for the 970/971/973 SmartRadar. Other display formats are same as with 854 ATG / XTG. Display format I (servo density) does not exist in SmartRadar LT.

Level and temperature display (format A)
Level display (format B)
Appendix C  Related documents

Installation guide Tank Side Indicator

Installation guide 854 XTG Servo gauge
Installation guide 854 Advanced Technology Gauge
Installation guide 970 SmartRadar ATi
Installation guide 971 SmartRadar LTi
Installation guide 973 SmartRadar LT

Instruction manual series 854 XTG level gauge
Instruction manual series 854 ATG level gauge
Instruction manual 970 SmartRadar ATi
Instruction manual 971 SmartRadar LTi
Instruction manual 973 SmartRadar LT
Index

Alive indication ....................................................... 5
Caution ................................................................... 6
Commissioning ....................................................... 7
Communication time-out ........................................ 8
Display .................................................................. 5, 9
  scrolling ................................................................ 9
Display contrast ..................................................... 8
Display format A ......................................................... 9
  lower display row .............................................. 5
  upper display row .............................................. 5
Error messages ...................................................... 11
Gauge commands .................................................... 10
Generic
  emission standard ............................................. 3
  immunity standard ............................................ 3
Host Command mode ............................................. 10
i.s. option ............................................................. 5
ICU_IS board ....................................................... 11
Items
  0B ........................................................... 7, 8, 10
  1A ............................................................. 5
  2A ............................................................. 5
  DG ............................................................. 7
  DJ ............................................................. 7
  HC ............................................................. 10

Keyboard .................................................................. 5, 7, 9
Level ................................................................... 5
Note ...................................................................... 6
Other gauge data ..................................................... 5
Pincode .................................................................. 7, 10
TSI ....................................................................... 8
Refresh rate ............................................................ 5
Related documents .................................................. 19
Safety .................................................................... 6
Supply ...................................................................... 5
Temperature ............................................................ 5
Tenth millimetre selection ....................................... 7
Transmission ........................................................... 5
Warning ................................................................. 6
XPU-2 board .......................................................... 5, 11
Zero format ............................................................. 7

Honeywell Enraf Instruction manual 977 Tank Side Indicator Page 23