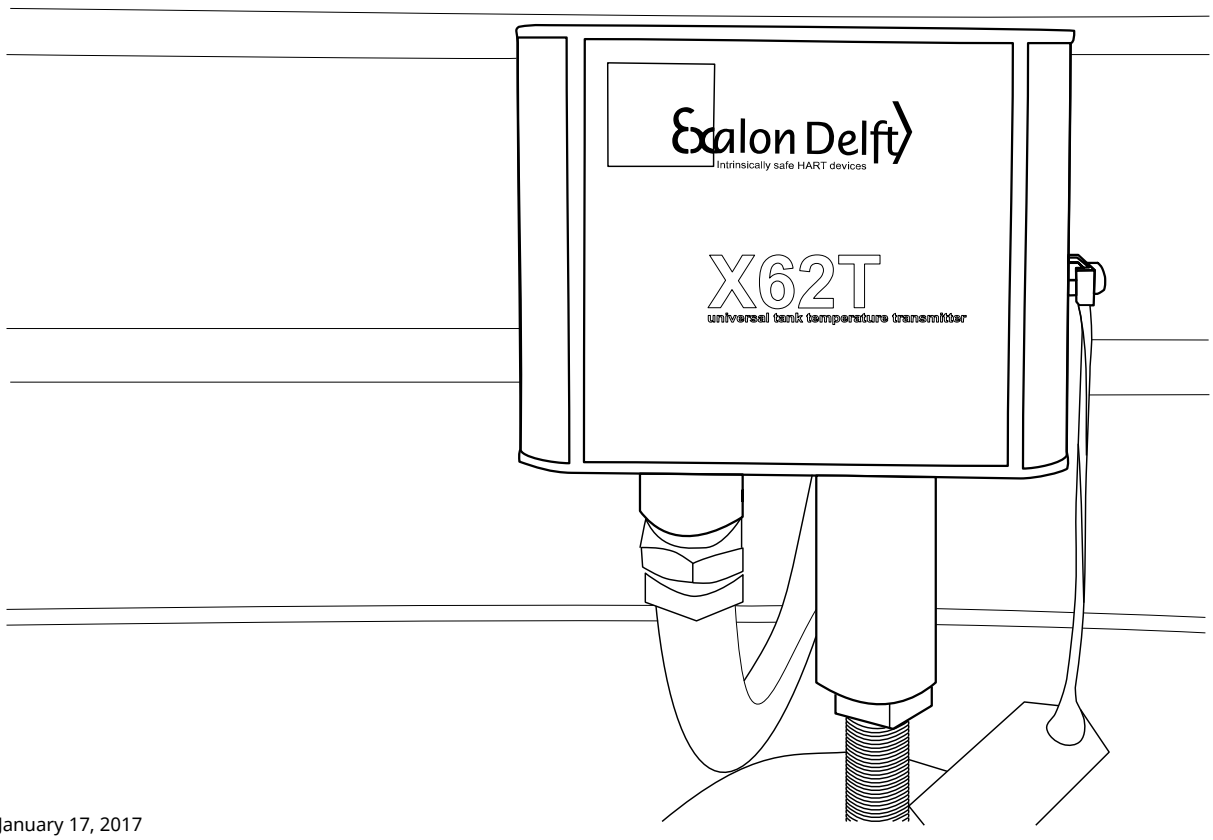
Excalon Delft
intrinsically safe HART devices

X62T-VT Installation Guide



Date: January 17, 2017
Rev. 1

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1 Preface

1.1 Document conventions

Warnings, **Cautions** and **Notes** are used throughout this installation guide 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 the attention to an action which may damage the equipment.
- A Note points out a statement deserving more emphasis than the general text.

1.2 Preface

This installation guide is intended for technicians involved in the mechanical and electrical installation of the Exalon Delft X62T Interface. The technician must have basic technical skills and knowledge of safety regulations and explosion proof equipment in hazardous areas and must work in accordance with the (local) requirements for electrical equipment in hazardous areas.

Warning
In hazardous areas it is mandatory 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.
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.
Pay attention to the kind of product in the tank. If any danger for health, wear a gas mask and take all necessary precautions.

The X62T is installed external to storage tanks and converts temperature and capacitance parameters from sensors provided by third parties which are installed inside the storage tank. Please refer to the sensor manufacturers installation guide for details on installing the sensor inside the tank.

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

Warning
Improper installation of cable glands, conduits or stopping plugs will invalidate the
Ex approval of the X62T Interface.

Caution
The X62T Interface has intrinsically safe output/input circuits. Modifications to the instrument may only be carried out by trained personnel with written authorization from Exalon Delft. Unauthorized modifications will invalidate the approval certificate and impair safety.

1.3 Legal aspects

The mechanical and electrical installation shall only be carried out by trained personnel with knowledge of the requirements for installation of explosion proof equipment in hazardous areas.

The information in this installation guide is the copyright property of Exalon Delft B.V., Netherlands. Exalon Delft B.V. 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, use of electricity and microwave radiation.

The contents, descriptions and specifications are subject to change without notice. Exalon Delft B.V. accepts no responsibility for any errors that may appear in this installation guide.

1.4 EC Declaration of Conformity

This Exalon Delft instrument is in conformity with all applicable EC Council Directives, including the EMC Directive 89/336/EC and the ATEX114 Directive 2014/34/EC. Refer to the EC Declaration of Conformity supplied with each instrument separately.

1.5 Additional information

Please do not hesitate to contact Exalon Delft or its representative if you require additional information.

2 Introduction

2.1 What is the X62T-VT?

The X62T is a Tank Thermometer transmitter based on the X62U multi-input HART transmitter. The X62U is a modern micro controller based transmitter design with inputs that are software configurable for precision resistor, thermocouple and capacitive sensor inputs. By programming different firmwares X62T-HART (HART configurable multi-input transmitter), X62T-MIT (Honeywell Enraf 862 MIT emulation), X62T-MIR (Honeywell Enraf 862 MIR emulation) and X62T-VT (Honeywell Enraf 762 VITO®or 762 VITO®LT emulation) are implemented.

Note
The single X62T-VT firmware can emulate the Enraf 762 VITO MTT and 762 VITO LT interface. The correct mode is selected by placing a resistor in the terminal. See further on in this manual.

Note
Currently emulation of Enraf 762 VITO MRT and MPT is not supported.

The X62T-VT can be connected to Enraf servo gauges 854 ATG and 854 XTG, 873 radar, 97x SmartRadar or 877 hydrostatic gauge that are fitted with appropriate option boards (see Section 4.1).

Both enclosure entry openings of the X62T-VT (in deviation from the X62T Installation Guide PN 500013) are PG16:

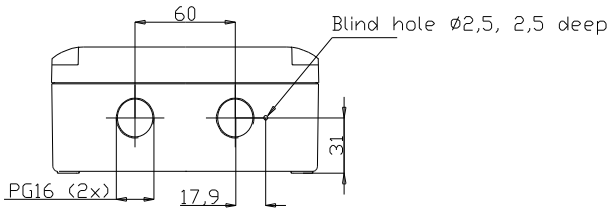
- The cable entry allows a PG16 cable gland or adapter to be used (not supplied).
- The MTT entry is also PG16 with positioning hole compatible to the original Enraf MTT G1/2-G1/2 adapter. If you are upgrading from a Enraf 862 MIT this adapter will already be glued on top of the 864 MTT. In a new installation or when replacing a Enraf 762 VITO you will require a Exalon Delft X62T-G1/2-M/F adapter (sold separately).

2 versions of the X62T-VT enclosure can be selected: X62T-VT/H and X62T-VT/W:

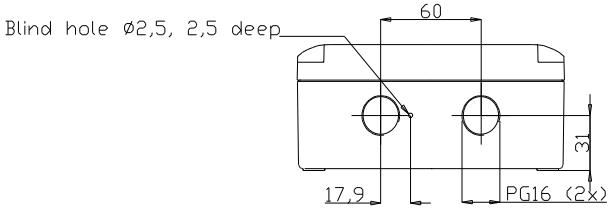
/H This is the default enclosure.

/W In certain installations with rigid conduits it may be difficult to mirror the external connections. In this case the /W enclosure can be applied. Internally the MTT wires will cross the host connection wires.
As the MIT wires and host wires are 2 different Intrinsically Safe circuits they

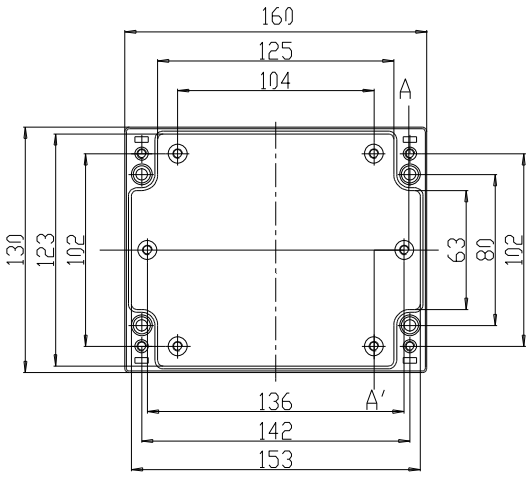
MUST be kept isolated with a total of > 0.5mm solid isolation. An additional isolation sleeve (not supplied) may be needed to increase solid isolation.

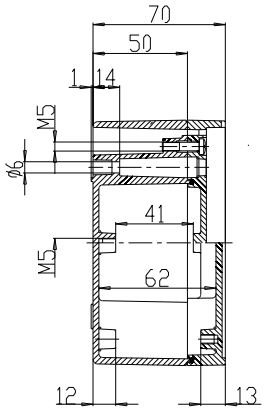


X62T-VT/H



X62T-VT/W





Mounting holes

3 Instructions for use in potentially explosive atmospheres

3.1 Explanation of the type identification code

Designation according to Directive 2014/34/EC: CE 0344 Ex II 2(1) G

- Notified body performing the QA surveillance: DEKRA Certification
- Equipment Group II : Surface Industries
- Equipment Category 2(1) : Suitable for installation in Zone 1 with wiring into Zone 0
- For explosive mixtures of gases, mists, or vapors in air

Ex marking (type of protection): **Ex ia IIB T4**

- Electrical apparatus with explosion protection Ex ia when connected to ATEX certified associated apparatus with protection [Ex ia] or Ex [ia]
- Gas group IIB
- Temperature class T4

EC-Type Examination Certificate Number: KEMA 06ATEX 0294X

Special conditions for use:
The programming terminal CN9 of the X62T is not Intrinsically Safe. Programming is only allowed using special tools provided by Exalon Delft.

Warning
Do not program the X62T in the Hazardous Area.

Caution
Connecting the X62T directly to a RS232 port may (unnoticeably) damage the Intrinsically Safe circuitry inside the X62T. The X62T shall only be connected to an Exalon Delft supplied programming adapter. Refer to your local distributor when a software upgrade is necessary.

3.2 Electrical connections

3.2.1 Environmental conditions

Temperature	-40 ºC < Ta < +70 ºC
Ingress Protection	IP65 (with proper installation)
Pressure	Atmospheric
Humidity	0 – 100%RH

3.2.2 Nominal input voltage

Input voltage	12V @ 4mA (low current mode) 14V @ 15mA (high current mode)

3.2.3 Ex i parameters

Power supply / Output circuit / HART (CN1)		Sensors / Input circuit (CN3) (circuits combined)	
Ui	30V	Uo	5.9V
Ii	270mA	Io	62mA
Pi	1.2W	Po	92mW
Ci	5nF	Co	900uF
Li	-	Lo	30mA

Power supply / Output circuit are infallibly galvanically isolated from Sensors / Input circuit.

3.2.4 Grounding

Proper grounding of the X62T Interface to the tank (P.E.) is required. Use the external ground terminal on the X62T Interface housing.

Warning
When measuring the ground resistance, use a suitable explosion-proof tester.

Note
Grounding shall be performed according to local regulations.

3.2.5 Lightning protection

The field bus terminals of the X62T are floating except for a 90V gas arrester. If the field wiring isolation needs to be tested the internal wire from terminal CN1-2 and CN1-4 (see Figure 2: Connection of MTT or VITO MTT probes) to the enclosure may need to be temporarily disconnected.

3.2.6 Wiring inside the enclosure

Supply and input circuits are separate Intrinsically safe circuits. Keep wiring separated with a minimum distance of 6 mm. When necessary use a suitable cable binder (not supplied) or isolation sleeve.

3.2.7 Supply cable

Follow local regulations for routing of I.S. wiring. Use shielded twisted pair, loop resistance < 50Ω. Using Co / Lo from the gauge:
Cc ≤ Co – 5nF, Lc ≤ Lo.

Note
Use metallic cable glands (M16/EMC/IP68) to provide good contact between cable shield and X62T Interface housing.
The shield of the cable shall be connected inside the cable gland and connected to ground at both ends of the cable.

4 Verification before installation

4.1 Compatibility of the X62T-VT to Enraf gauge option boards

The X62T-VT can be connected to HCU (854 Servo, 873 Radar) or HPI (97x SmartRadar) option boards to emulate Honeywell Enraf 762 VITO or 762 VITO LT transmitters.

> ***Note***
> *Not all Honeywell Enraf option board versions support all functions. As the X62T-VT closely emulates 762 VITO and VITO LT the same limitations apply to the X62T-VT as to Honeywell Enraf 762 VITO interfaces.*

Certain older versions of HCU/HPI firmware can only support the VITO but not the VITO LT (see Table 1: Option boards installed in the gauge and supported functions). If unsure what is supported by your HCU/HPI please contact your Honeywell Enraf representative.

Internally in the gauge the HCU communicates with the XPU board. Depending on the XPU HW and SW version the HCU might be configured to emulate a MPU option board, which only supports VITO, but not VITO LT.

To find out the software version issue command SV.

> ***Note***
> *To issue commands directly at the gauge you require a PET (Portable Enraf Terminal).*
> *Alternatively there are tools available to connect to the Enraf Fieldbus and issue commands to the gauge from the safe area.*

Table 1: Option boards installed in the gauge and supported functions

Command	Example	Interpretation
SV	SV973 NVR1.0-- XPUK1.0-- APUB1.0 HCUA1.0	HCUA1.0 no VITO LT support
	SV854 NVR2.2-- XPUH2.4-- SPUB2.2 HCUA1.9	HCUA1.9 supports VITO LT
	SV973 NVR1.0-- XPUK1.0-- APUB1.0 MPUC121	MPU/HPU (emulation) no VITO LT support
	SV973 NVR1.0-- XPUK1.0-- APUB1.0 HSUC106	HSU (emulation) does not support VITO
VP=00.01	VVHCU CONFIG: 2E	HCU with option 0A 2E 1A 3F support VITO

Command	Example	Interpretation
VP=00.00	VVMPU HC-------- VVHPU HC-------- VVHSU HC--ST---- VVMPU HC--MT---- VVHCU HC--MTWT--	MPU emulation, no VITO connected HPU emulation, no VITO connected HSU emulation, no VITO supported MPU emulation, VITO detected HCU mode, VITO + VITO water bottom probe detected

When supported by the XPU preferably select HCU mode instead of MPU or HPU emulation. Selection is done by jumpers on the option board. Please refer to the Honeywell Enraf manual on changing emulation type.

4.2 Compatibility of the X62T-VT to MTT probes

The X62T-VT supports the same MTT probes as the obsolete Enraf 862 MIT interface as well as 76□ VITO MTT based probes (see Table 2: Supported MTT probes).

You can identify a compatible probe from the identification code on the type plate:

□□□□YYYX□□□0□□□0

Table 2: Supported MTT probes

YYY	X	Description
864		Supported obsolete 16 spot probe. Pt100 at 65mm from probe bottom.
764	A	Supported obsolete 16 spot probe. Pt100 is the second spot at 1m from the probe bottom. Lowest spot at 65mm from probe bottom.
764	B	Supported obsolete 16 spot probe. Pt100 is the lowest spot at 65mm from probe bottom.
764	C	16 spot temperature probe, Pt100 is the lowest spot at 1m from probe bottom.
764	D	16 spot temperature probe. Pt100 is the second spot at 1m from the probe bottom. Lowest spot at 65mm from probe bottom.
766	A	Supported obsolete combined water and 16 spot temperature probe. Pt100 is the lowest spot at 1m from probe bottom.
766	B	Supported obsolete combined water and 16 spot temperature probe. Pt100 is the second spot at 1m from the probe bottom. Lowest spot at 65mm from probe bottom.
766	C	Combined water and 16 spot temperature probe. Pt100 is the lowest spot, location see table.
766	D	Combined water and 16 spot temperature probe. Pt100 is the second spot, location see table. Lowest spot at 65mm from probe bottom.

YYY	X	Description
767	C	9 spot temperature probe, Pt100 is the lowest spot at 1m from probe bottom.
767	D	9 spot temperature probe. Pt100 is the second spot at 1m from the probe bottom. Lowest spot at 65mm from probe bottom.
768	C	Combined water and 9 spot temperature probe. Pt100 is the lowest spot, location see table.
768	D	Combined water and 9 spot temperature probe. Pt100 is the second spot, location see table. Lowest spot at probe bottom.
765	*	VITO Water probe only – not supported.
863		MRT probe – not supported.
361		MPT probe – not supported.
365		Combined MPT and Water probe – not supported.

When the Pt100 is the second spot, the lowest spot is a thermocouple. This lowest thermocouple spot is always wired with an ORANGE wire. With an ORANGE wire present, the probe type is D (or an obsolete B)

4.3 Determine mechanical dimensions

Mechanical dimensions can be determined from the MTT probe type identification plate. You will need these dimensions to configure the gauge correctly.

- The sensitive length is always measured from the position of the Pt100 to the highest element. This will be needed to configure item MK in the gauge.
- The lowest spot position is measured from the bottom of the probe to the center of the lowest spot element. This will be needed to configure item MO in the gauge. Item MO is configured as the height from Tank Zero to the position of the lowest element. As a result, the height from tank zero to the bottom of the MTT needs to be added to the position of the lowest spot element (see Table 3: Mechanical dimensions).

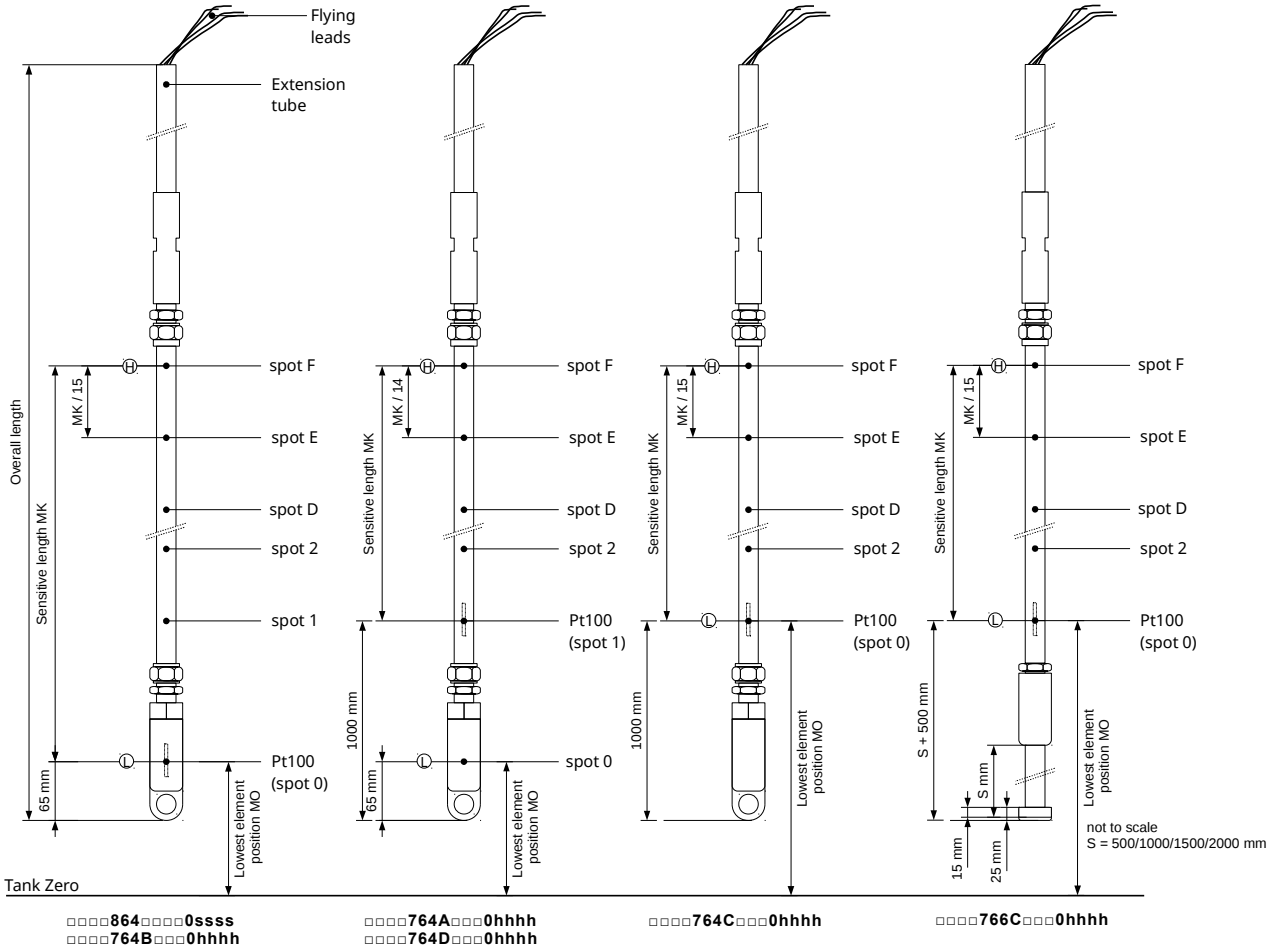


Table 3: Mechanical dimensions

	Water probe sensitive length **WP**	Lowest spot element position **MO**	Pt100 position	Temperature sensitive length **MK**
766C and 768C combined probe				
□**A**□□**76**□**C**□□□**0hhhh**	485mm	1000mm	1000mm	hhhh - 100 [cm]
□**B**□□**76**□**C**□□□**0hhhh**	985mm	1500mm	1500mm	hhhh - 150 [cm]
□**C**□□**76**□**C**□□□**0hhhh**	1985mm	2500mm	2500mm	hhhh - 250 [cm]
766D and 768D combined probe				
□**A**□□**76**□**D**□□□**0hhhh**	485mm	65mm	1000mm	hhhh - 100 [cm]
□**B**□□**76**□**D**□□□**0hhhh**	985mm	65mm	1500mm	hhhh - 150 [cm]
□**C**□□**76**□**D**□□□**0hhhh**	1985mm	65mm	2500mm	hhhh - 250 [cm]
766 A and B combined probe				
□□□□**76**□**A**□□□**0hhhh**	485mm	1000mm	1000mm	hhhh – 100 [cm]
□□□□**76**□**B**□□□**0hhhh**	485mm	65mm	1000mm	hhhh – 100 [cm]
764/767 temperature probe				
□□□□**764A**□□□**0hhhh**	0	65mm	1000mm	hhhh – 100 [cm]
□□□□**764B**□□□**0hhhh**	0	65mm	65mm	hhhh – 6.5 [cm]
□□□□**76**□**C**□□□**0hhhh**	0	1000mm	1000mm	hhhh - 100 [cm]
□□□□**76**□**D**□□□**0hhhh**	0	65mm	1000mm	hhhh - 100 [cm]
864 temperature probe				
□□□□**864**□□□□**0ssss**	0	65mm	65mm	ssss – 6.25 [cm]

To verify if the correct values have been entered you can check the values of item UF (16 element probe) or U8 (9 element probe). This item contains the position of the highest element (without MO having been added).

5 Installation

5.1 Powering the X62T-VT

The X62 can be configured to draw a constant current of either 4 mA or 16 mA. When programmed with X62T-VT firmware preferably the low current mode should be selected (SW1 BROWN in OFF position).

In low current mode the X62 requires a voltage between 12V and 24V on the terminals CN1-1 and CN1-3 and larger than 14V in high current mode. When connected to an Enraf HCU or HPI option board in low current mode the supply voltage will always be sufficient (> 16V).

Note
The HCU/HPI has 2 HART channels. Channel 2 will deliver only 12.5V with the X62T-VT in high current mode. Select low current to operate on Channel 2.

Note
Issuing a reset command to the gauge (RS) will temporarily cut power and RESET the X62.

5.2 Mechanical connection

In case of an upgrade from 862 MIT to X62T-VT an Enraf G1/2-G1/2 M/F adapter may already be installed on the adjusting pipe. This will be compatible with the X62T enclosure and does not need to be replaced if the O-ring is in good condition.

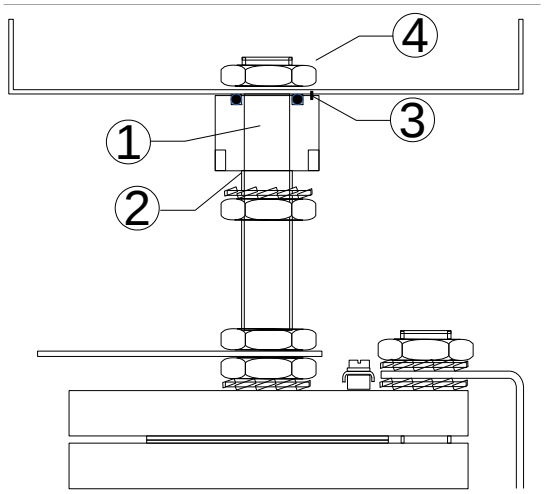


Figure 1: X62T-VT installation

- Open the cover from the X62T enclosure.

- Remove the X62U from the enclosure.
- Place the empty X62T enclosure on top of the adapter (1) carefully positioning the position pin (3) in the enclosure blind hole.
- Secure the X62T enclosure using the half height G1/2 hexagon nut (4) and supplied shake proof washer until the O-ring is fully compressed and the enclosure will not be able to move.
- Turn the SS G1/2 hexagon nut onto the adjusting pipe (2) until 50mm of thread is free and place the SS shake proof washer.
- Feed the MTT wiring through the G1/2-G1/2 M/F adapter (1).
- Apply a suitable thread locking pipe sealant on the first 25mm of the MTT adjusting pipe (2).
- Turn the adapter (1) tightly onto the adjusting pipe (2) using a wrench on the adapter (3). Tighten the SS hex nut.

Caution
Do not attempt to tighten by applying force to the enclosure as this will damage the positioning pin.

5.3 Electrical connection MTT, VITO MTT or VITO LT temperature

- Connect the MTT or VITO MTT probes according to Figure 2: Connection of MTT or VITO MTT probes.
- Connect VITO LT probes according to Figure 3: Connection of VITO LT probes.

Caution
Discharge tools to the tank before bringing into contact with the X62 terminals to prevent ESD (electrostatic discharges). Then FIRST connect one BROWN wire to terminal 3 on CN3. Damage due to ESD related events are not covered by the warranty.

Connect blue wires to the terminals with blue color in the drawing, yellow to the yellow terminal, etc.:

- If an orange wire is present connect this to terminal 19 of CN3 and set SW2 RED to ON.
- The X62T-VT recognizes a VITO LT probe by the presence of a 270Ω 5% 1/4W resistor between terminal 2 and 6.

Note
The X62T-VT comes with a 270Ω 5% resistor installed. It must be removed for MTT or VITO MTT operation.

- Unused BLUE inputs on terminal 7 – 12 on CN3 should be connected to terminal 4 (GND) on CN3.

Note

The X62T-VT will operate with unused inputs left floating. However this may cause tiny temperature offsets on used inputs, startup time will be increased and EMC degraded.

5.3.1 Switching between VITO-MTT and VITO-LT probes

VITO-LT probes have less spot temperatures than VITO-MTT probes (9 vs. 16). This has been achieved by reducing the number of BLUE wires.
For the X62T-VT measuring LT probes this means terminal 6 – 12 are not used for temperature measurement. By connecting a 270Ω ± 5% between Terminal 6 and Terminal 2 on the X62T-VT before setting Ordering Mode, the thermocouple order will be detected assuming a LT probe is attached. Order and type of probe (MTT or LT) is stored in the X62T memory.

Note

Changing from VITO to LT mode or vice versa by connecting the resistor will cause the X62T-VT to change its HART address from 5 to 6 or vice versa. As a result the gauge will detect an interrupted HART communication. If this occurs the gauge will need to be reset using item RS.

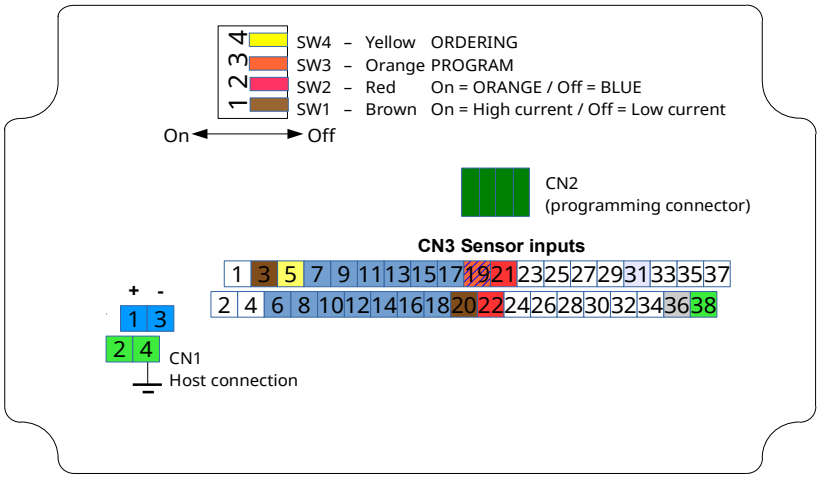


Figure 2: Connection of MTT or VITO MTT probes

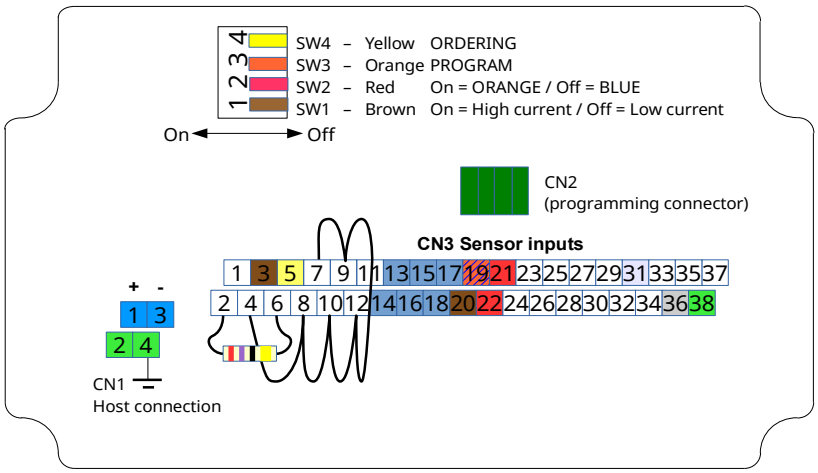


Figure 3: Connection of VITO LT probes

5.3.2 Steps to Setup the X62T-VT for use with an MTT or VITO MTT/LT

- Set switch SW1 BROWN in Off position to enable low current mode.
- Set switch SW2 RED in Off position if there is NO ORANGE wire, ON if there IS an ORANGE wire.
- Set switch SW3 ORANGE in Off position to have the X62 start in Run Mode.
- Enable order detection of the thermocouples by setting switch SW4 YELLOW in On position. See the next section for details.
- Turn power of X62T on. Wait for 3 minutes minimum to perform the order detection.
- Turn power of X62T off and set switch SW4 YELLOW in Off position. All other switches need to be left in their current positions.

After the order detection is complete temperature should be indicated on the display or the PET.

Example

The display indicates +023.97FL ---I1 meaning temperature has been detected but the gauge needs configuration.

Example

The PET item AP = IF@@9999999 meaning temperature is not ready.

AP = C@@@+023.97 indicates correct temperature, with C = '0' - 'F' indicating the highest submerged spot element.

5.3.3 Order Detection of Thermocouples

Note

With 762 VITO the detection of the connection order is done by the HCU/HPI on each startup. The result is that when one of these wires is broken the order cannot be detected and temperature measurement status will show a failure.
For improved reliability in the X62T-VT order detection is done once during commissioning and the results are stored in the X62T-VT non-volatile memory. The connection order of the blue wires and the therefore the position of the spots is presented to the HCU/HPI in the correct order. The result is that the X62T-VT will always measure all spots that are correctly connected.

The Blue thermocouples of the MTT or VITO MTT/LT can be connected in any order. Using the Yellow switch SW4 the X62T can be configured to determine the connection order during power-up. This can take up to 2 minutes.

After detection the X62T stores the detected order in internal persistent storage (EEPROM) and uses this for operation. Once the correct connection order has been determined and stored turn off Ordering using SW4 YELLOW.

As the order of wires is stored in EEPROM the X62T will continue to function after power-up, even when a MTT wire is broken and automatic order detection is no longer possible.

Note

After connecting or reconnecting MTT wires the order of the Blue wires will most likely be changed and the correct thermocouple order must be re-detected. To make the X62T re-determine the order set switch SW4 YELLOW (Ordering) in position 'On' and turn the gauge power off and on or issue an RS command using the PET..

5.4 Electrical connection MTT, VITO MTT or VITO LT water probe

The X62T-VT does not support VITO water probe only types. Only combined temperature and water probes are supported. See 4.2 Compatibility of the X62T-VT to MTT probes for the supported type codes on the type identification plate.

- Connect the MTT or VITO MTT Combined water and temperature probes according to Figure 4: Connection of water probes.

Caution

Discharge tools to the tank before bringing into contact with the X62 terminals to prevent ESD (electrostatic discharges). Then FIRST connect the GREEN wire to terminal 38 on CN3. Damage due to ESD related events are not covered by the warranty.

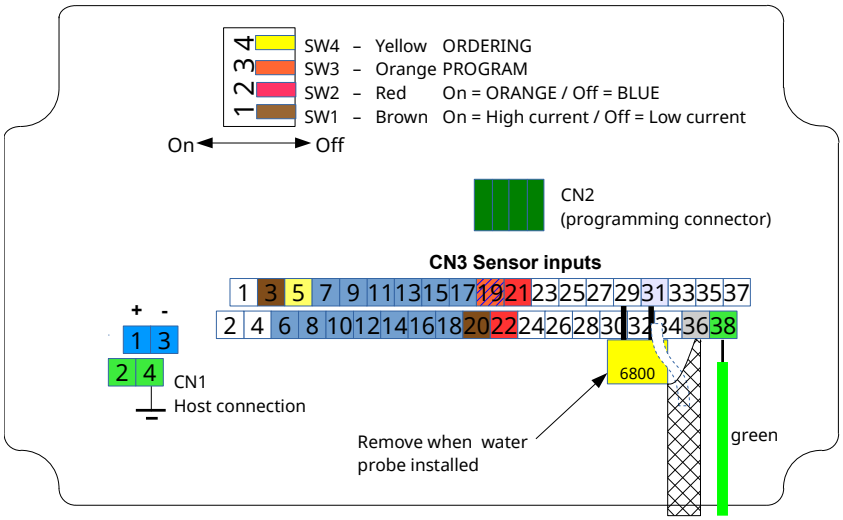


Figure 4: Connection of water probes

> ***Note***
> *The X62T-VT comes with a 6800pF capacitor installed. When the capacitance is installed the HCU/HPI option board will assume no capacitive water sensor is present. The capacitor must be removed to connect a water probe. If no water probe is connected this capacitor must be placed.*

- Remove the capacitor from terminal 29 (GND) and 31 of CN3
- Connect the GREEN wire to terminal 38 of CN3 (GND)
- Connect the cable shield to terminal 36 of CN3 (Active guard)
- Connect the cable core to terminal 31 of CN3 (Capacitance input C1)

6 Commissioning MTT, VITO and VITO LT temperature

6.1 Commissioning

The following settings are intended to set up temperature measurement quickly, for settings customized to your local installation please consult your gauge manual or download the document *"Item documentation for Honeywell Enraf series 854 Level Gauges, 97x series SmartRadars Gauges and 877 Field Display & Interface"*, Part no.: 4416277 from http://www.honeywellprocess.com.

Item	Name	Description
W2	Protection level 2	Default W2=ENRAF2
TD	Temperature dimension	Default TD=C (Celsius)
MT	Element type	MT=SPL
MR	Reference Resistance	+.22200000E+03
MK	Sensitive length temperature probe	Use the value from Table 3: Mechanical dimensions. Default MK=+030.0000 (m)
MO	Temperature element offset	Use the value from Table 3: Mechanical dimensions. Default MO=+000.0000 (m)
MI	Switch hysteresis	Default MI=+000.1000 (m)
MP	Product immersion depth	Default MP=+000.5000 (m)
MG	Gas immersion depth	Default MG=+000.5000 (m) for 854, 97x Default MG=+000.1000 (m) for 877
WP	Water probe length	Use the value from Table 3: Mechanical dimensions. Default WP=+001.0000 (m)
MJ	Temperature distribution	Disables the lowest element from the average temperature calculation. This is necessary to comply with API and ISO recommendations that the lowest element used for average temperature calculation is positioned 1m from the bottom of the tank. If the product level drops below 1m the lowest element will be used to calculate the average product temperature. The temperature status 'level below lowest element' will be set. If MO is less then 1m MJ should be set to F if you

Item	Name	Description
		require API/ISO compliance. This item is implemented in HCU/HPI firmware A1.8 or higher and is not yet documented in the "Item documentation ..." rev. 5 (August 2013). For older firmware use MW. Default MJ=F (lowest element disabled) Alternative MJ=C (lowest element enabled)
MW	MTT wiring connection	Only set this item for HCU/HPI firmware before A1.8 when MO is less than 1m. Setting this will disable the lowest element. Default MW=0000000000000000 (all elements enabled) Alternative MW=F000000000000000 (lowest element disabled)
TU	Temperature status conversion	The character used to indicate a reduced accuracy for the temperature status caused by: • temperature out of range • temperature gradient out of range • last valid level used • manual level used • level below the lowest element Default TU=T
EX	Exit	

Additional temperature settings may apply for the 877 FDI. Please refer to the document *"Instruction manual VITO interface and average temperature (and water) probes for 854 servo, 97x SmartRadar and 877 FDI",* Part no.: 4416.655 from http://www.honeywellprocess.com for more information.

6.2 Operation

If the gauge is equipped with a display, depending on the selected display format a correct temperature measurement will show the temperature followed by the selected unit of temperature 'C' or 'F' (example: +027.13°C –--I1). Incorrect temperature may show FL (example +023.97FL ---↓I1).

Without display, temperature related data may be retrieved using the PET.

Item	Name	Description
AP	Average product temperature	The temperature is preceded by 4 status bytes. The first byte indicates the highest submerged spot element (‘0’ ... ‘F’). During startup it will be ‘I’. Under normal operation the remaining three status bytes will be ‘@’
AG	Average gas temperature	Same as AP.
EM	Temperature system error	Last encountered error. If no errors after initialization will be: 2200 (MPU emulation) 2400 (HPU emulation) 3000 (HCU emulation)
MU	Value of the X62T test resistor	166.5Ω ± 0.03% when EM shows no errors
U0 - UF	Relative spot position	As calculated by the gauge without adding item MO
V0 - VF	Spot temperature	Temperature of the spot (V0 is the lowest spot) preceded by the temperature status (same as AP).

6.3 Troubleshooting

The X62T-VT firmware measures all MTT Pt100 and thermocouple elements independently from the HCU/HPI option board. Errors are detected in a much earlier stage than with the 762 VITO namely when calculating the resistance and voltages from the individual sub-measurements and before communicating the end result to the HCU/HPI.
Further, the X62T-VT orders the thermocouple wires prior to sending the measurement results to the HCU/HPI. As a result the HCU/HPI does not know the real connection order to the X62T-VT and item RW will always shows the spots ordered '0123456789ABCDEF'.

For diagnostic purposes the X62T-VT provides the following mechanism:

- A X62T hardware failure purposely generates a large error shown in the value of the measured internal test resistor. The value is transmitted to the gauge to item MU and will a cause a fatal error in the temperature measurement system in the HCU/HPI.
- A non-fatal error in an MTT element measurement is indicated generating temperature out of range error for that element only in the HCU/HPI.

Step	Check	Description	Next
1	Check display unit C or F or Check AP status=x@@@	An invalid temperature on the display will not have the temperature unit and 'FL' may be shown. x indicates the highest submerged spot. @@@ indicates no errors or warnings. See Table 4 Temperature status Byte 1 .	3
2	Check EM		
	xx00	No last error available.	3
	xx11 xx92 xx70	No initial communication. Communication interrupted. Subsystem error.	4
	xx51-xx64	Spot 1-14 not connected (non fatal).	5
	xx65	Spot 0 or 15 not connected.	6
	xx80	Rtest error, X62T-VT signals a fatal error.	7
3	MU V0 - VF	Value of the X62T test resistor 166.5Ω ± 0.03% . Temperature of the spot (V0 is the lowest spot) preceded by the temperature status (as AP).	Stop
4	Check voltage on CN1 1-3	> 14V. See 5.1 Powering the X62T-VT. Set SW1 to low current or correct wiring to HCU/HPI.	End
5	Check MU	MU=+.1665ttxx, with tt[1] the terminal on CN3. If the wire can not be repaired disable the spot using item MW.	End
6	Check V0	If V0 shows a temperature, spot 15 is not wired correct (non fatal if ordering complete). If the wire can not be repaired disable the spot using item MW.	
	Check MU	MU=+.1665ttxx[1], with tt the terminal on CN3. Correct the wiring.	End

1 ttxx may need to be rounded to the nearest value.
Example: +.16651999E+03 refers to terminal 20.

Step	Check	Description	Next
7	Check MU	If MU < 64[2], MU is the sum of 1 Internal power supply failed 2 Internal power supply failed 4 Internal power supply failed 8 Internal Test Resistance failed 16 Internal Test Capacitance failed 32 Internal Test Capacitance failed Example: MU=+.69999995E+01 nearest integer 7 = 1 + 2 + 4, all internal power supplies failed. If MU 180 ... 183 there is a Pt100 wiring error. 180 BROWN wire on CN3-20 is disconnected 181 RED wire on CN3-21 is disconnected 182 RED wire on CN3-22 is disconnected 183 BROWN wire on CN3-3 is disconnected (CN3-3) If MU 184 ... 185 there is an EMC error. 184 EMC error, to much noise 185 EMC error, to much noise If MU 205 ... 223 there is a wiring error. Ordering can not complete due to a disconnected spot (fatal), with tt the terminal on CN3. 2tt tt not connected 223 GND wire not connected Correct the wiring. If MU 200 the wiring error has been resolved. Reset the gauge.	End
End	Contact Exalon Delft for support		

6.4 Display Examples

When all temperature measurements succeeded the display will show for example

```
+009.3121 m  INN
+025.71°C ----I1
```

2 Round MU in Enraf floating point format +.mmmmmmmmE+ee to the nearest integer

Then MU would be +.16650675E+03 and EM would be 2200.

When Spot 1 on T5 is disconnected the display will show for example

```
+009.3120 m  INN
+025.74FL ----I1
```

where FL indicates 'General MPU/HPU fail'. Then MU would be +.166505000E+03 and EM would be 2289.

When the PT100 wire on T22 is disconnected the display will show for example

```
+009.3120 m  INN
+999.99FL ----I1
```

where FL indicates 'General MPU/HPU fail'. Then MU would be +.18200000E+03 and EM would be 2280.

Table 4: Temperature status Byte 1

	Spot element fail (one or more spots defect)	Level exceeds highest spot element	Level exceeds lowest spot element	Fail in average gas temperature	Fail in average product temperature	General temperature fail
@	0	0	0	0	0	0
A	0	0	0	0	0	1
B	0	0	0	0	1	0
C	0	0	0	0	1	1
D	0	0	0	1	0	0
E	0	0	0	1	0	1
F	0	0	0	1	1	0
G	0	0	0	1	1	1
H	0	0	1	0	0	0
I	0	0	1	0	0	1
J	0	0	1	0	1	0
K	0	0	1	0	1	1
L	0	0	1	1	0	0
M	0	0	1	1	0	1
N	0	0	1	1	1	0
O	0	0	1	1	1	1

	Spot element fail (one or more spots defect)	Level exceeds highest spot element	Level exceeds lowest spot element	Fail in average gas temperature	Fail in average product temperature	General temperature fail
P	0	1	0	0	0	0
Q	0	1	0	0	0	1
R	0	1	0	0	1	0
S	0	1	0	0	1	1
T	0	1	0	1	0	0
U	0	1	0	1	0	1
V	0	1	0	1	1	0
W	0	1	0	1	1	1
X	0	1	1	0	0	0
Y	0	1	1	0	0	1
Z	0	1	1	0	1	0
[	0	1	1	0	1	1
\	0	1	1	1	0	0
]	0	1	1	1	0	1
^	0	1	1	1	1	0
_	0	1	1	1	1	1

	Spot element fail (one or more spots defect)	Level exceeds highest spot element	Level exceeds lowest spot element	Fail in average gas temperature	Fail in average product temperature	General temperature fail
`	1	0	0	0	0	0
a	1	0	0	0	0	1
b	1	0	0	0	1	0
c	1	0	0	0	1	1
d	1	0	0	1	0	0
e	1	0	0	1	0	1
f	1	0	0	1	1	0
g	1	0	0	1	1	1
h	1	0	1	0	0	0
i	1	0	1	0	0	1
j	1	0	1	0	1	0
k	1	0	1	0	1	1
l	1	0	1	1	0	0
m	1	0	1	1	0	1
n	1	0	1	1	1	0
o	1	0	1	1	1	1

	Spot element fail (one or more spots defect)	Level exceeds highest spot element	Level exceeds lowest spot element	Fail in average gas temperature	Fail in average product temperature	General temperature fail
p	1	1	0	0	0	0
q	1	1	0	0	0	1
r	1	1	0	0	1	0
s	1	1	0	0	1	1
t	1	1	0	1	0	0
u	1	1	0	1	0	1
v	1	1	0	1	1	0
w	1	1	0	1	1	1
x	1	1	1	0	0	0
y	1	1	1	0	0	1
z	1	1	1	0	1	0
{	1	1	1	0	1	1
|	1	1	1	1	0	0
}	1	1	1	1	0	1
~	1	1	1	1	1	0
	1	1	1	1	1	1

7 Commissioning VITO and VITO LT water probe

The following settings are intended to set up water bottom measurement quickly. For settings customized to your local installation please consult your gauge manual or download the document *"Item documentation for Honeywell Enraf series 854 Level Gauges, 97x series SmartRadars Gauges and 877 Field Display & Interface"*, Part no.: 4416277 from http://www.honeywellprocess.com.

7.1 Calibration

For a quick setup the Honeywell Enraf factory calibration values for the maximum and minimum capacity of the water probe are listed on the "Checklist 765/766/768 Final Assembly", delivered with every VITO water probe.

As these values are influenced by the actual installation using the factory calibration values will negatively impact water bottom accuracy. A system calibration on-site is highly recommend for best accuracy.

For the detailed probe calibration procedure refer to Appendix B of Honeywell Enraf document *"Instruction manual VITO interface and average temperature (and water) probes for 854 servo, 97x SmartRadar and 877 FDI",* Part no.: 4416.655 from http://www.honeywellprocess.com for more information.

To calibrate item VR we recommend following "Situation 2 (probe fully covered with product)" where possible as during installation it is in many cases possible to temporarily position the probe in the tank at such a height that it is fully covered with product. This can be achieved for instance by elevating the bottom of the water probe above the water level in the tank (assuming there is little or no water present). This procedure allows item VR to be easily determined by retrieving the value from item MX.

When no water is present in the tank item VT can not be calibrated and the value from the "Checklist 765/766/768 Final Assembly", delivered with every VITO water probe should be used (see Note below).

When the water level exceed 10cm additionally Situation 3 (probe partly covered by water and partly covered by product) should be followed. The water level should be measured using a manual dip. The VR can be calculated as follows:

$$\%\ \text{water} = \frac{\text{Water level} - \text{WB}}{\text{WP}} \quad ,$$

$$VT = \frac{MX - VR}{\%\ water/100} + VR \quad ,$$

with VR and MX read by the PET or the service program.

Example:
The probe bottom is positioned on the tank floor, the sensitive part of the probe starts 25mm above the bottom end. Therefore item WB = 25mm. The probe sensitive length = 485mm (see Table 3). A manual dip shows 100mm water is present. Retrieving VR (as calibrated before) from the gauge shows 120.93pF, and MX is 168.786pF.

Now,
% water = (100 – 25) / 485 x 100% = 15.464%
VT = (168.786 – 120.93) / 0.15464 + 120.93 = 430.4pF.

> ***Note***
> *Item VT does not depend strongly on the position of the water probe in the tank.. It does however depend on the internal reference capacitor of the X62T-VT.*
>
> *Without calibration of item VT the accuracy of the water level (item LW) is 2% of the measured value (M.V). Although not stated in the VITO Instruction Manual this is the same for the 762 VITO.*
> *With proper calibration the X62T-VT can achieve an accuracy of ±0.1% M.V ± 1mm.*

After calibration be sure to record the calibration values for VR and VT in a secure place as they might be erased in the gauge in case it needs to be initialized to factory settings in the future.

7.2 Commissioning

The following settings are intended to set up water bottom measurement quickly, for settings customized to your local installation please consult your gauge manual or download the document *"Item documentation for Honeywell Enraf series 854 Level Gauges, 97x series SmartRadars Gauges and 877 Field Display & Interface"*, Part no.: 4416277 from http://www.honeywellprocess.com.

Item	Name	Description
W2	Protection level 2	Default W2=ENRAF2
VR	Capacitance at 0% water	In pF. See 7.1 Calibration. Default +.00000000E+00

Item	Name	Description
VT	Capacitance at 100% water	In pF. See 7.1 Calibration. Default +.00000000E+00
WB	Water probe bottom position	The height from tank zero to the bottom end of the probe + 25 mm.
WP	Water probe length	Use the value from Table 3: Mechanical dimensions. Default WP=+001.0000 (m)
WF	Water level field communication	Only for 854 level gauges. Default: D. Sends displacer water dip to the system. Alternative: S. Sends water probe to the system.
WH	Water high alarm	Sets water high alarm. Default: +000.0000 m.
WL	Water low alarm	Sets water low alarm. Default: +000.0000 m.
WS	Water alarm hysteresis	The amount the water level must drop after reaching the high alarm or rise after reaching the low alarm to turn of the alarm. Default: +000.0100 m
EX	Exit	

7.3 Operation

Item	Name	Description
LW	Water innage	2 status bytes, followed by water level. Example: @@+000.0244
LH	Water ullage	2 status bytes, followed by water ullage
MX	Measured capacitance	The probe capacitance in pF.
EW	Water measurement error	Last encountered error. If no errors after initialization will be: 2200 (MPU emulation) 2400 (HPU emulation) 3000 (HCU emulation)

7.4 Troubleshooting

For a detailed description of HCU/HPI error codes refer to Chapter 5.4 of Honeywell Enraf document *“Instruction manual VITO interface and average temperature (and*

water) probes for 854 servo, 97x SmartRadar and 877 FDI", Part no.: 4416.655 from http://www.honeywellprocess.com for more information.

Step	Check	Description	Next
1	Check LW status=@@	An invalid water level with @@ indicates no errors or warnings. See Table 5 Water status bytes .	4
2	Second status byte = A	Water probe not detected during startup.	5
3	First status byte shows General Probe Fail (Table 5: Water status bytes)	Water probe detected during startup, but disconnected or shorted to GND later.	6
4	LW MX	LW shows the water level. MX shows the measured capacitance between VR and VT.	Stop
5	EW	3005 No probe connected to CN3-31 3098 Dummy capacitor connected to CN3-31 or probe shorted to GND. Repair connection.	End
6	EW	3005 Probe no longer connected to CN3-31 3006 Probe capacitance higher than maximum allowed or probe shorted to GND. Repair connection.	End
End	Contact Exalon Delft for support		

Table 5: Water status bytes

Status byte 0

	Water above probe warning	Water below probe warning	High water alarm	Low water alarm	General probe fail
@	0	0	0	0	0
A	0	0	0	0	1
B	0	0	0	1	0
C	0	0	0	1	1
D	0	0	1	0	0
E	0	0	1	0	1
F	0	0	1	1	0
G	0	0	1	1	1
H	0	1	0	0	0
I	0	1	0	0	1
J	0	1	0	1	0
K	0	1	0	1	1
L	0	1	1	0	0
M	0	1	1	0	1
N	0	1	1	1	0
O	0	1	1	1	1

	Water above probe warning	Water below probe warning	High water alarm	Low water alarm	General probe fail
P	1	0	0	0	0
Q	1	0	0	0	1
R	1	0	0	1	0
S	1	0	0	1	1
T	1	0	1	0	0
U	1	0	1	0	1
V	1	0	1	1	0
W	1	0	1	1	1
X	1	1	0	0	0
Y	1	1	0	0	1
Z	1	1	0	1	0
[	1	1	0	1	1
\	1	1	1	0	0
]	1	1	1	0	1
^	1	1	1	1	0
_	1	1	1	1	1

Status byte 1

	Water probe not present
@	0
A	1

Exalon Delft
electronic product design

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