Installation guide
873 SmartRadar Control Unit & Antenna Unit

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Enraf BV
PO Box 812
2600 AV Delft
Netherlands

Tel. : +31 15 2701 100
Fax : +31 15 2701 111
E-mail : info@enraf.nl
Website : http://www.enraf.com
Preface

The 873 SmartRadar is a radar-based level gauge for liquid storage tanks.

This installation guide is intended for technicians involved in the mechanical and electrical installation of the Enraf series 873 SmartRadar Control Unit and Antenna Unit.

EC declaration of conformity

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

Note:

All connections to the instrument must be made with shielded cables with exception of the mains, alarm outputs and Enraf field bus cable. The shielding must be grounded in the cable gland on both ends of the cable.

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.

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- 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.

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

Additional information

Please do not hesitate to contact Enraf or its representative if you require additional information.
Safety

Safety aspects of 873 SmartRadar

**Warning**

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

The housing of the 873 SmartRadar is explosion-proof:

- II 1/2 G EEx de [ib/ia] IIB T6; KEMA 02ATEX2301 X, certified by KEMA, Netherlands.
- Class I, Division 1, Groups B, C & D according to ANSI/NFPA, certified by Factory Mutual Research Company (FM no.: 2Z5A6.AE).

Environmental conditions for the 873 SmartRadar are:

- ambient temperature: -40 to 65 °C (-40 to 149 °F)
- operating pressure:
  - atmospheric for RoD antenna
  - max. 6 bar for F06, F08, S06 .. S12, W06 and T06 antennas
  - max. 20 bar for H02 antenna
  - max. 40 bar for H04 antenna
- relative humidity: 0 - 100 %
- ingress protection: IP65 (NEMA4), suitable for outdoor installation

The covers of Antenna Unit and Control Unit are provided with blocking facilities which prevent unauthorised opening.

The Control Unit has two separate cable entries for intrinsically safe options.

**Warning**

*Improper installation of cable glands, conduits or stopping plugs will invalidate the Ex approval of the SmartRadar.*

The emitted microwave energy is far below acceptable limits for exposure to human body. Depending on the type of antenna, a maximum radiation of 0.03 mW/cm² is generated.
Personal safety

The technician must have basic technical skills to be able to safely install the equipment. When the 873 SmartRadar is installed in a hazardous area, the technician must work in accordance with the (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.

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.

Safety 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, but not requiring a “Warning” or a “Caution”.
Mechanical installation

Note:
The entire installation procedure shall be in accordance with national, local and company regulations.

Mechanical installation Control Unit

The installation of the Control Unit is common for all antenna types. The Control Unit can be installed on or next to the tank.

Maximum distance from Antenna Unit: 150 m (500 ft).

Place Control Unit against a vertical mounting plate (or other suitable place).

Minimum size for the mounting plate is: 230 mm (9") height by 140 mm (5½") width.

Note:
Weight of Control Unit is 14 kg (31 lbs).

Refer to appendix A for dimensions of Control Unit and drilling plan of mounting holes.

Figure 1 gives an example of the Control Unit installation.

Note:
Leave sufficient space for the infra red connector at the bottom left side of the Control Unit and for removal of the front and rear cover.

Refer to the dimensional drawing of the Control Unit in appendix A.

Caution
The Control Unit, its mounting plate and the Antenna Unit must have the same ground reference (grounded to the tank).
Mechanical installation Antenna Unit

The installation is common for all Antenna types. Refer to appendix A for the dimensions of the Antenna Unit.

Antenna and tank separator should already be installed (refer to installation guide SmartRadar antennas).

Install Antenna Unit on the tank separator as follows:

1) Place Antenna Unit on tank separator; mind locking pin!
2) Turn coupling nut manually securing the Antenna Unit

Note:
The H04 tank separator has two locking pin holes. Position Antenna Unit so that the locking pin of the Antenna Unit is placed in the locking pin hole which is 90° away from the vent plug (figure 2).

Caution
The Antenna Unit and Control Unit must have the same ground reference (grounded to the tank).
## Electrical installation

The entire electrical installation shall be in accordance with the International Standard IEC 79-14 for electrical equipment to be installed in hazardous areas.

### Warning

Make sure that all power to the instrument is switched off before opening the covers of the 873 SmartRadar. Failure to do so may cause danger to persons or damage the equipment.

All covers of the 873 SmartRadar (Control Unit and Antenna Unit) must be closed before switching on the power.

### Caution

Before opening the covers of the Control Unit, make sure that the blocking devices (‘A’ for the front cover and ‘B’ for the rear cover) are removed (figure 3).

Use Allen key 3 mm.

![Blocking / sealing facilities](image)

### Caution

Do not damage the thread of covers and the Control Unit and Antenna Unit and keep the thread free of dirt.

After opening, grease it lightly with anti seize grease.

When closing, never tighten the covers before the threads are properly engaged. The covers should be turned counter-clockwise until the thread "clicks" in place, then turn clockwise until the covers are fully closed.

After closing the covers, do not forget to place the blocking devices.
Preparing SmartRadar for electrical installation

Mains voltage selector

Check whether voltage selector is set correctly as indicated on identification label of Control Unit as well as for the presented supply.

The voltage selector is located inside electronic compartment at top of the backplane (figure 4).

The Control Unit operates on a mains voltage of 110, 130, 220 (+10% to -20%) and 230 Vac (±15%).

A special 65 Vac (+10% to -20%) is available.

Power rating: 25 VA; frequency: 50 to 60 Hz (±10%); \( I_{\text{max}} = 2 \text{ A} \).

Install an explosion-proof mains switch in the mains supply cable to each Control Unit.

Specify which switch you need to operate the SmartRadar Control Unit.

**Note:**

For 240 V supply voltage, set voltage selector to 230 V.
Supply voltage may then vary +10% to -20%.

To change the voltage setting, proceed as follows:

1) Check the local mains voltage
2) Open front cover of Control Unit
3) If necessary, change voltage selector to applicable voltage:
   - remove mains supply indication plate
   - slide switch in appropriate position (figure 4)
   - place mains supply indication plate and lock it
4) Close front cover

**Caution**

Changes of the mains setting **shall** be marked on the identification label of the Control Unit.
External fuses

The 873 SmartRadar Control Unit is internally fused on secondary side of the transformer (fuses are located on GPS board). Therefore, external fuses must be installed in the mains supply cable to each Control Unit.

<table>
<thead>
<tr>
<th>Mains voltage</th>
<th>Fuse value (in accordance with IEC 127-2-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>220 / 230 Vac</td>
<td>315 mA slow</td>
</tr>
<tr>
<td>110 / 130 Vac</td>
<td>630 mA slow</td>
</tr>
<tr>
<td>65 Vac</td>
<td>1 A slow</td>
</tr>
</tbody>
</table>

Grounding

The Control Unit and Antenna Unit should be properly grounded to the ground reference (generally the tank). This is a safety grounding requirement.

For this purpose, the Control Unit and Antenna Unit have external ground terminals.

**Caution**

Antenna Unit and Control Unit must have the same ground reference.

**Caution**

Safety depends on proper grounding. Check the resistance of the ground connection directly after installation. The measured ground resistance shall be below the maximum prescribed by local grounding requirements.

**Warning**

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

**Note:**

Grounding shall be performed in accordance with local regulations.
Cable glands / conduit

Cable glands:
Explosion-proof (Ex-d) or increased safe (Ex-e) cable glands must be used, depending on local requirements. Refer to the Ex-marking on the identification label of the Control Unit to determine which type of cable gland is required.

Note:
Mount the glands according to the supplier’s instructions.

Conduit:
If the SmartRadar is installed in a hazardous area, threaded rigid metal conduit or threaded steel intermediate metal conduit shall be used.

Note:
If the SmartRadar is installed in a hazardous area, stopper boxes must be applied within 18 inches (0.45 m) from the Antenna Unit and Control Unit to seal the cabling in the conduits.

Depending on the wiring configuration, two or more ¾" NPT threaded cable glands (or rigid conduits) may be required with the Control Unit.

The Antenna Unit requires a (flexible) conduit with one ½" NPT connection at the Antenna Unit side. The length of the flying leads from the Antenna Unit is 4 metres (13 ft).

If the Control Unit is located within this distance, a direct connection can be made between Antenna Unit and Control Unit.

If the distance is longer, a junction box and a separate four-core cable is required.

The optional Enraf installation kit contains a flexible conduit (1 m) with ½” NPT connections and an Ex-e junction box with ¾” NPT cable entry (refer to appendix A).
Note:
Seal the unused cable inlets with an approved ¾” NPT threaded stopping plug.

**Warning**
Improper installation of cable glands, conduit or stopping plugs will invalidate the Ex approval of the 873 SmartRadar.

**Non-intrinsically safe cabling**

The terminal compartment of the Control Unit is divided in a non-intrinsically safe part and an intrinsically safe part.

Cable entries are all ¾” NPT.

The non-intrinsically safe cabling may only enter at the centre and two right hand side cable entries (figure 6).

**Warning**
Only open the terminal compartment cover (rear cover) when the power is switched off.

![Figure 6 Terminal compartment Control Unit](image)
Non-intrinsically safe connections

Mains cabling : Must be suitable for 873 SmartRadar power ratings and, moreover, approved for use in hazardous areas.

Enraf field bus : One twisted pair cable is recommended. $R_{\text{max}} = 200 \ \Omega / \text{line}; \ C_{\text{max}} = 1 \ \mu F$. Maximum distance: 10 km. Enraf field bus lines may be interchanged. If local regulations allow, mains and Enraf field bus lines may share one cable. Mind the isolation voltage of the cores in the cable; refer to the International Standard IEC 61010-1.

Note: If a quad cable is used and all four cores are twisted together, use two opposite cores for Enraf field bus lines and the two others for mains.

AU cabling : Flying leads must be run in a (flexible) conduit, which gives EMC protection. For longer connections than the 4 metres of flying leads:

- Maximum length: 150 m (500 ft); twisted pairs and shielded;
- $R_{\text{max}} = 2.5 \ \Omega / \text{line}; \ C_{\text{max}} = 15 \ \text{nF}$.

Relay outputs : Option. The relay contacts are potential free. Contact rating: $U_{\text{max}} = 50 \ \text{Vac} \text{ or } 75 \ \text{Vdc}$; $I_{\text{max}} = 3 \ \text{A non-inductive (CSA only: 0.6 A)}$.

Mind the isolation voltage of the cores in the cable; refer to the International Standard IEC 61010-1.

Analog output : Option. Use shielded cable. External supply voltage: minimum: 12 Vdc; maximum 64 Vdc (figure 8).
When the supply voltage exceeds 30 Vdc, an additional resistor is required. The permitted operational areas are shown in figure 8.

Operational area 1 represents the area of operation without the need for an external loop resistance.

Operational area 2 shows the area where a resistance is required.

The power rating of the external resistor depends on the value of the resistor.

We recommend: 1 W / kΩ.
Optional RS communication connections

For the mains, Antenna Unit and optional relay output cabling, refer to previous section.

**Caution**
*Keep the RS-232C / RS-485 lines as short as possible.*

RS-232C : Option. Cable: maximum length 15 m (50 ft); twisted and shielded.
RS-485  : Option. Cable: maximum length 1200 m (3900 ft); twisted and shielded.

![Diagram of RS-232C or RS-485 connections]

Figure 9  RS-232C or RS-485 connections
Intrinsically safe connections

The cables for the intrinsically safe option(s) shall only be fed through the cable entries at the side of the intrinsically safe (blue) terminals. Blue marked cables are recommended for the intrinsically safe options.

**Caution**
*The intrinsically safe options described in this section are explosion-proof certified. Make sure that the certificate of approval is available on site and act in accordance with the instructions as given in the approval certificate.*

**Caution**
*Intrinsically safe wiring shall be separated from all other wiring. Cable lay-out shall be in accordance with local regulations.*

**Note:**
*The shield of the intrinsically safe cable shall not be connected inside the Control Unit housing. Connect the shield of the cable externally in the cable gland at both ends of the cable.*

### Device

<table>
<thead>
<tr>
<th>Device</th>
<th>Cable requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot temperature element</td>
<td>Shielded; ( R_{\text{max}} = 12 \ \Omega / \text{line} ).</td>
</tr>
<tr>
<td>Average temp. element (combined water probe)</td>
<td>Twisted pair and shielded; ( R_{\text{max}} = 25 \ \Omega / \text{line} ).</td>
</tr>
<tr>
<td></td>
<td>Wiring between Control Unit and 762 VITO must be protected with EMC shielded conduit. Same conditions for connection to 862 MIR</td>
</tr>
<tr>
<td>Pressure transmitters</td>
<td>Twisted pair and shielded; ( R_{\text{max}} = 25 \ \Omega / \text{line} ) (only pressure transmitters with HART® protocol). Pressure transmitter P1 is the bottom transmitter (measures liquid head) and P3 is the top transmitter (measures vapour pressure).</td>
</tr>
<tr>
<td>Water bottom probe (no VITO water sensor)</td>
<td>Twisted pair and shielded; ( R_{\text{max}} = 25 \ \Omega / \text{line} ) (only with HART® protocol).</td>
</tr>
</tbody>
</table>

**Note:**
*If pressure transmitters are also connected, use a junction box for the parallel connection of the pressure transmitters and water bottom probe.*
Note:

If pressure transmitters are connected to HART input 2, it must be verified that the maximum values for current and power of the HCU option board HART input 2 circuit are not exceeding the maximum values of the connected pressure transmitters. Refer to Appendix B.

If the values of the HART input 2 circuit are too high, then connect the pressure transmitters to HART input 1 and the 762 VITO Interface to HART input 2 (only possible when HART input 1 is available).
Figure 11 Intrinsically safe connections with MPU-3 / HPU option board
Appendix A   Dimensional drawing

873 SmartRadar Control Unit
873 SmartRadar Antenna Unit

Clearance for cover removal:

- Diameter: 245 (9 5/8")
- Height: 195 (7 11/16")
- Height: 111 (4 3/8")
- Height: 17 (1 11/16")

Distance to flange:
- Nom.: 100 (3 15/16")
- Max.: 120 (4 3/4")

(dependents on flange thickness)
Mounting holes ø6.5 (4x)

Flexible conduit, length 1 m. with couplings ½" NPT

Terminal detail n°1 AKZ.4PX numbered

873 SmartRadar installation kit
Appendix B  ATEX Approval

The terminal compartment of the 873 Control Unit has been ATEX approved as explosion-proof and as being increased safe. The type of cable glands that must be used:

For protection type increased safe   EEx e approved glands are to be used.
For protection type explosion proof  EEx d approved glands or conduit are to be used.

Connection requirements of optional boards
The identification label on the Control Unit indicates whether your instrument is equipped with an optional board with intrinsically safe measuring circuits.

**HCU option board, [EEx ia] IIB**
Spot temperature input circuit:
- Max. values : $U = 23.1 \text{ V}; I = 221 \text{ mA}; P = 0.19 \text{ W}$
- Max. permissible ext. inductance : $3.5 \text{ mH}$
- Max. permissible ext. capacitance : $980 \text{ nF}$

HART input 1 circuit (for 762 VITO Interface):
- Max. values : $U = 23.1 \text{ V}; I = 90 \text{ mA}; P = 0.52 \text{ W}$
- Max. permissible ext. inductance : $15 \text{ mH}$
- Max. permissible ext. capacitance : $1.02 \mu\text{F}$

HART input 2 circuit (for HART® pressure transmitters and/or external water probe):
- Max. values : $U = 23.1 \text{ V}; I = 148 \text{ mA}; P = 0.86 \text{ W}$
- Max. permissible ext. inductance : $7 \text{ mH}$
- Max. permissible ext. capacitance : $1.02 \mu\text{F}$

**MPU-3 option board, [EEx ib] IIB**
862 MIR input circuit:
- Max. values : $U = 21 \text{ V}; I = 231 \text{ mA}; P = 0.88 \text{ W}$
- Max. permissible ext. inductance : $3 \text{ mH}$
- Max. permissible ext. capacitance : $1.27 \mu\text{F}$
HPU option board, [EEx ib] IIB
862 MIR input circuit:
Max. values : \( U = 21 \, \text{V} \); \( I = 221 \, \text{mA} \); \( P = 0.86 \, \text{W} \)
Max. permissible ext. inductance : \( 3 \, \text{mH} \)
Max. permissible ext. capacitance : \( 1.27 \, \mu \text{F} \)

HPU option board, [EEx ia] IIB
HART input circuit (for HART\textsuperscript{®} pressure transmitters and/or external water probe):
Max. values : \( U = 21 \, \text{V} \); \( I = 148 \, \text{mA} \); \( P = 0.72 \, \text{W} \)
Max. permissible ext. inductance : \( 6 \, \text{mH} \)
Max. permissible ext. capacitance : \( 1.27 \, \mu \text{F} \)
Appendix C   Related publications

Installation guide 873 SmartRadar Antennas

Instruction manual 873 SmartRadar
Instruction manual APU Hard alarm output contacts
Instruction manual SmartRadar verification pin compensation

Installation guide 762 VITO Interface & 764, 765 or 766 VITO temperature and/or water sensor

Instruction manual XPU-2 option RS-232C/RS-485
Instruction manual Temperature, Water bottom and Analog output options
Instruction manual HIMS / HTG and vapour pressure (P3) measurement
Instruction manual 847 PET

Installation Info 003 (Installation HIMS systems)

Identification code 873 SmartRadar
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