MS2900L Transmitter

Operator's Manual

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Contents

1 SAFETY INSTRUCTIONS / DISCLAIMER

1.1 Designated use

The CorrTran MV is a compact, 4-20 mA corrosion transmitter used to detect general corrosion, localized corrosion, and conductance in a wide range of industries. The transmitter measures the corrosion rate and pitting factor, giving the readout in mil/year or a 0-1 pitting factor, respectively. It also provides a conductance measurement. The readings are taken in real time and are updated every 21 minutes.

1.2 Installation, commissioning, and operation

CorrTran MV is designed to operate safely in accordance with relevant technical and safety standards. If installed incorrectly or used for applications for which it is not intended, application-related dangers may arise. For this reason, the instrument must be installed, connected, operated, and maintained according to the instructions in this manual by appropriately trained personnel. This manual must be read, understood, and the instructions must be followed. Modifications and repairs to the device are permissible only when they are expressly approved in this manual.

1.3 Operational safety

Measurement systems used in a hazardous (classified) area must comply with all existing national standards. CorrTran MV can be supplied with the certificates listed in Table 1. All technical personnel must be sufficiently trained. All measurement and safety regulations that apply to the measuring points must be observed.

CorrTran MV CMC M - _ _ _ _ _ _ _ _ _ - _ _ - _ _ _ _ _ - _ _ - _ _ _

Code	Certificate	Protection
GP	N/A	General Purpose
D2	cCSAus	NI: Cl. I, II, III; Div. 2: Groups A…G
IS	cCSAus Ex	IS: Cl. I, II, III; Div. 1, 2; Groups A…G II 1G EEx ia IIC T4
EX	cCSAus	EX: Cl. I; Div. 1,2; Groups A…D

Table 1. Certificates for Application in Hazardous Areas

General-purpose versions of CorrTran MV shall only be used to detect corrosion in tanks and pipes that are non-hazardous (non-explosive). Failure to comply with this specification will create a potentially hazardous situation.

1.4 Maintenance safety

The transmitter must be mounted with the safety warning label visible at all times to any employee or other person called upon to replace the electrodes or otherwise service the transmitter. The label is on every safety bracket with adjustable probes. Please see section 6.4 for ordering instructions.

⚠ DANGER ⚠

DO NOT REMOVE THIS DEVICE UNLESS PIPE OR VESSEL HAS FIRST BEEN DEPRESSURIZED AND PURGED OF ANY HAZARDOUS SUBSTANCES. DEATH OR INJURY MAY RESULT IF SAFETY PROCEDURES ARE NOT OBSERVED.

1.5 Notes on safety conventions and symbols

The following conventions are used to highlight safety-relevant or alternate operating procedures in this manual and are shown in the margin where appropriate.

Safety conventions

Symbol	Meaning
STOP Warning	A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard, or destruction of the instrument.
Attention	A caution highlights actions or procedures that, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.
Note	A note highlights actions or procedures that, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.
	A terminal symbol indicates that a protective grounding (earth) terminal must be connected to earth ground prior to making any other connection to the equipment.

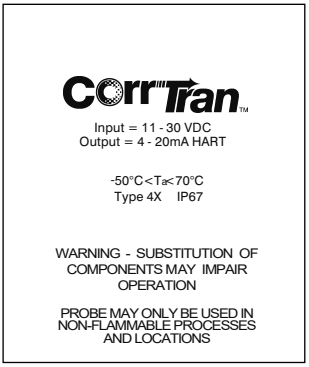
1.6 Disclaimer

Metal Samples has no power, nor does it undertake to police or enforce, compliance with the contents of this manual or observance of the safety precautions set forth herein. Metal Samples does not certify, test, or inspect the installations of CorrTran MV for safety or other purposes. Metal Samples disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon this manual. Metal Samples makes no guaranty or warranty, express or implied, as to the accuracy or completeness of any information published in this manual, and disclaims and makes no warranty that the information in this manual will fulfill any particular purposes or needs. Metal Samples' only warranty is set forth in the written Limited Warranty specifically provided by Metal Samples in connection with the purchase of the CorrTran MV.

2 IDENTIFICATION

2.1 Device designation

2.1.1 Nameplates



2.1.2 Key to model number

C M C M - □□□ □□ □ □□□ - □□ - A 2 I H □ - □□ - □□□

Insertion Length (fixed probes only)
in inches, 5" … 28", in 0.2" increments
050 5.0"
052 5.2"
…
278 27.8"
280 28.0"

in mm, 130mm … 710mm, in 5mm increments
130 130mm
135 135mm
…
705 705mm
710 710mm

Certificates
D2 cCSAus, NI, Cl. I,II,III; Div. 2, Group A-D
Ex cCSAus, EX, Cl. 1; Div. 1,2; Group A-D
GP gneral purpose
IS cCSAus, IS, Cl. I, II, III; Div. 1, 2; Group A-D
Ex II 1G EEx ia IIC T4

Transmitter Mounting
1 direct mount
2 remote mount with 1.8m (6') cable
3 remote mount with 3.6m (12') cable
4 special mount
5 remote mount with 1.8m (6') cable with retrievable probe adapter
6 remote mount with 3.6m (12') cable with retrievable probe adapter

Electrical Output
IH 4-20 mA, HART

Housing
A2 aluminum housing, Nema 4x, 3/4" NPT

Electrode Material
0A… see electrode material guide

Probe Length
050* 5", 3/4" NPT
080 8", 3/4" NPT
110* 11", 3/4" NPT
120 12", 3/4" NPT or Flange
180 18", 3/4" NPT or Flange
240 24", 1" NPT, 3/4" NPT, or Flange
300 30", 1" NPT, 3/4" NPT, or Flange
127* 127 mm, 3/4" NPT
204 204 mm, 3/4" NPT
280* 280 mm, 3/4" NPT
305 305 mm, 3/4" NPT or Flange
457 457 mm, 3/4" NPT or Flange
610 610 mm, 1" NPT, 3/4" NPT, or Flange
762 762 mm, 1" NPT, 3/4" NPT, or Flange
ADP Retrievable Probe Electrical Adaptor
*epoxy probe only

Probe Mounting
See probe mounting guide

Measurement Unit, Probe Material
CB inches, 1.4435, 316L
CC inches, hastelloy C
CF inches, epoxy glass
DB mm, 1.4435, 316L
DC mm, hastelloy C
DF mm, epoxy glass
HF HF applications, no glass seal
CS Special, consult factory

Process Connection
A31 1", flange ANSI B 16.5, 150 lbs
A32 1", flange ANSI B 16.5, 300 lbs
A61 2", flange ANSI B 16.5, 150 lbs
A62 2", flange ANSI B 16.5, 300 lbs
F61 DN40 PN6 Form B Flange
F65 DN40 PN40 Form B Flange
N21 3/4" NPT, ANSI B 1.20.1, 1.4435/316L
N2P 3/4" NPT, ANSI B 1.20.1, adj. thread, nylon
N31 1" NPT
U31 UNS 1-14, 1" left handed thread
XXX Special Version
*Consult factory for other available options

Corrosion Type
M Multivariable

**Probe Mounting Guide and Electrode Material Guide can be found in the Appendix.*

2.2 Contents of delivery

Attention

It is essential to follow the instructions concerning the unpacking, transport, and storage of this instrument given in section 2.3, “Incoming acceptance, transport, storage.”

The contents of delivery consist of:

- Assembled instrument
- Stainless steel probe
- 3-electrode elements (finger types attached loosely in box)
- Cable (remote mount version only)
- Accessories (if any are ordered)
- Instruction manual (this document)

2.3 Incoming acceptance, transport, storage

2.3.1 Incoming acceptance

Check the packing and contents for any signs of damage. Check the shipment to ensure that all parts have been included and to verify that the shipment matches your order.

Warning

All probes are shipped with the insulating gaskets installed. Upon removing the protective cap, ensure that the O-rings are not loose. The O-rings are made of Viton® (standard) or Kalrez (on request). If they are not installed, the probe will not operate properly. Please refer to Figure 17 on page 20.

2.3.2 Transport

Protect the transmitter electrodes from damage. Do not attempt to carry the transmitter by its electrodes.

2.3.3 Storage

Always pack the instrument for storage or transport to protect it against impact. The original packing material provides the optimum protection for the device. The permissible storage temperature is -40 °F to +176 °F (-40 °C to +80 °C).

2.4 Certificates and approvals

The CorrTran MV is designed to meet relevant safety requirements. It has been fully tested to ensure that it is in safe operating condition. The instrument complies with the applicable regulations in accordance with known standards.

2.5 Registered trademarks

HART®
Registered trademark of HART Communication Foundation, Austin, USA

Viton®
Registered trademark of the company E.I. Du Pont de Nemours & Co., Wilmington, USA

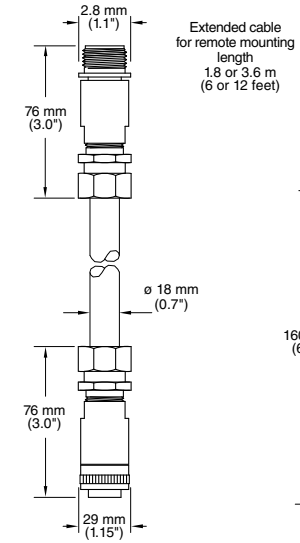
Teflon®
Registered trademark of the company E.I. Du Pont de Nemours & Co., Wilmington, USA

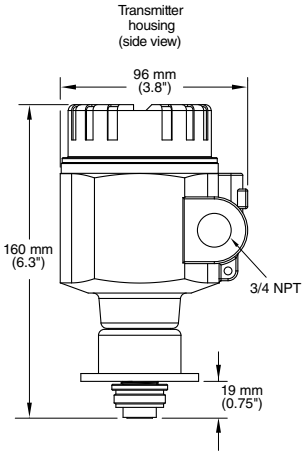
2.6 Patents

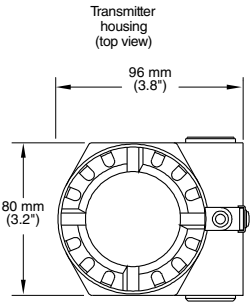
This instrument is protected by one or more patents registered in the US Patent Office.

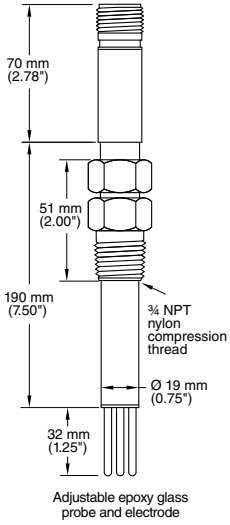
3 INSTALLATION AND MOUNTING

3.1 Dimensions

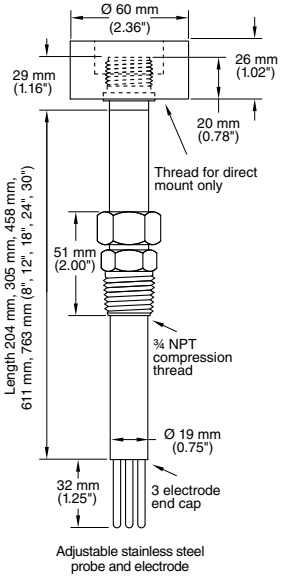




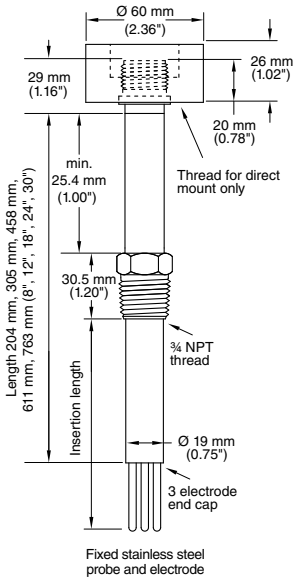




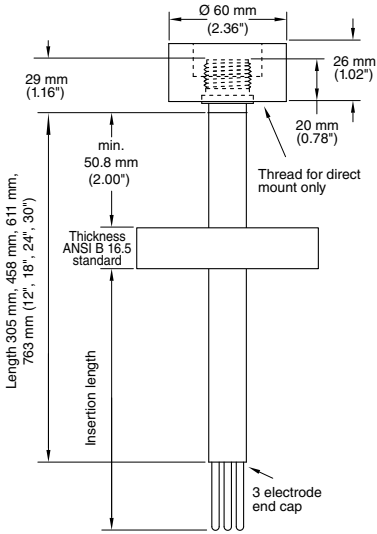
Adjustable epoxy glass
probe and electrode



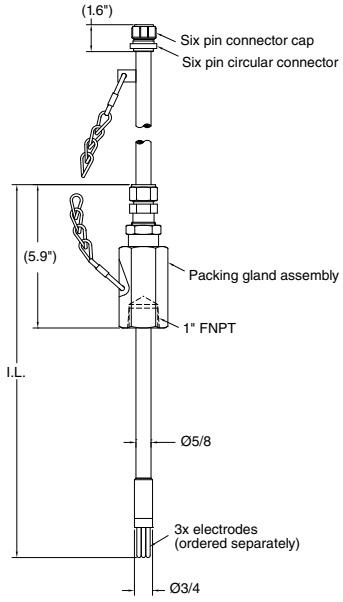
Adjustable stainless steel
probe and electrode



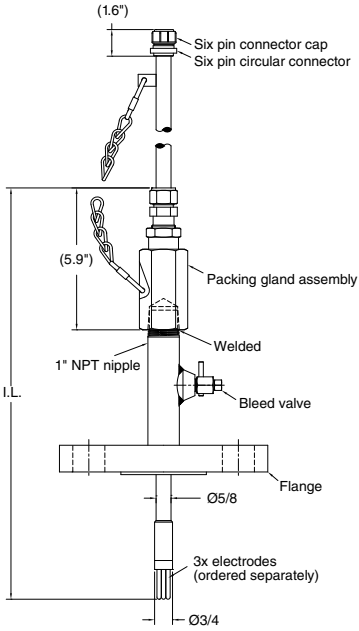
Fixed stainless steel
probe and electrode



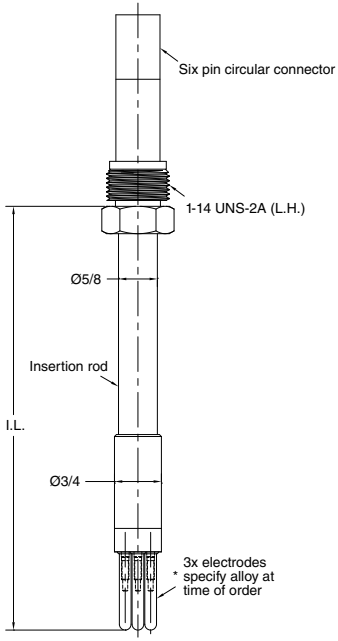
Stainless steel probe
with fixed flange



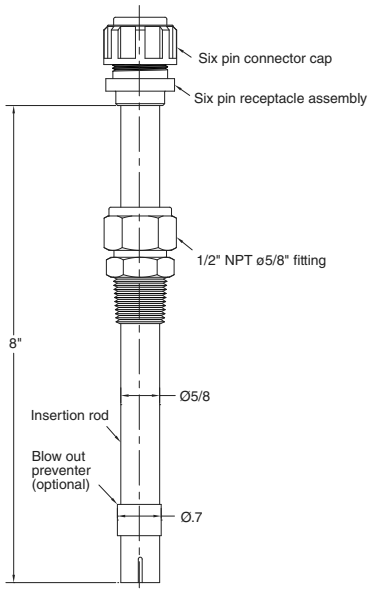
Retractable probe & electrode,
remote mount



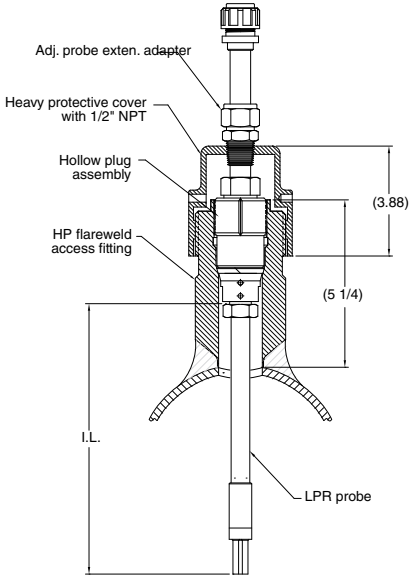
Retractable flange & electrode,
remote mount



Retrievable probe & electrode,
remote mount



Retrievable probe adapter,
remote mount



Retrievable probe complete
assembly, remote mount

3.2 Probe specifications

CMP epoxy adjustable probe

The CMP epoxy adjustable probe (Figure 1) consists of a glass epoxy probe with a ¾" NPT nylon compression fitting for insertion into the system. The studs for mounting the electrodes and the six-pin connector are held in place by the epoxy fill material. This probe is available in 127 mm and 280 mm (5" and 11") lengths only. This probe is only available with the remote mounting option.

Electrodes shown in the picture are ordered separately.

Specifications	
Probe Body	Glass epoxy
Endcap Seal	Epoxy
Fill Material	Epoxy
Process Temperature	-50…65 °C (-58…149 °F)
Pressure Rating	7 bar (100 psi)
Mounting	3/4" NPT nylon fitting
Standard Lengths	127, 280 mm (5, 11")
Custom Lengths	N/A
Insertion Length	Adjustable, Max = probe length - 89 mm (3.5") + EL

*EL = 32 mm (1.25") for finger and 0 mm (0") for flush electrodes

Figure 1. CMP Epoxy Adjustable Probe

CMP adjustable probe

The CMP adjustable probe (Figure 2) is an adjustable probe commonly used in many field applications. The assembly consists of a ¾" NPT compression fitting, an insertion rod with a hermetically sealed three-electrode end cap, and a six-pin connector welded in place. The insertion length is adjustable using the compression fitting. This probe is only available with both the remote and direct mounting options.

Electrodes shown in the picture are ordered separately.

Specifications	
Probe Body	1.4435, 316L SS; Hastelloy C
Endcap Seal	Glass
Fill Material	Epoxy
Process Temperature	Direct mount: -50…121 °C (-58…250 °F) Remote mount: -50…260 °C (-58…500 °F)
Pressure Rating	102 bar (1500 psi)
Mounting	3/4" NPT fitting
Standard Lengths	204, 305, 457, 610 mm (8, 12, 18, 24")
Custom Lengths	Lengths available in increments of 10 mm (0.5"). Min: 170 mm (7"), Max: 762 mm (30")
Insertion Length	Adjustable, Max = probe length - 51mm (2.0") + EL

*EL = 32 mm (1.25") for finger and 0 mm (0") for flush electrodes

Figure 2. CMP Adjustable Probe

CMP fixed probe

The CMP fixed probe (Figure 3) is a fixed-length probe. The probe assembly consists of a ¾" NPT pipe plug that is welded in place, an insertion rod with a three-electrode end cap, a hermetically sealed connector, and a six-pin connector welded in place. The insertion length (I. L.) is calculated to the end of the electrode and must be specified by the customer. This probe is only available with both the remote and direct mounting options.

Electrodes shown in the picture are ordered separately.

Specifications	
Probe Body	1.4435, 316L SS; Hastelloy C
Endcap Seal	Glass
Fill Material	Epoxy
Process Temperature	Direct mount: -50…121 °C (-58…250 °F) Remote mount: -50…260 °C (-58…500 °F)
Pressure Rating	206 bar (3000 psi)
Mounting	3/4" NPT fitting
Standard Lengths	204, 305, 457, 610 mm (8, 12, 18, 24")
Custom Lengths	Lengths available in increments of 10 mm (0.5"). Min: 170 mm (7"), Max: 762 mm (30")
Insertion Length	Fixed, Max = probe length - 38 mm (2.5") + EL, Length specified in 5 mm (0.2") increments.

*EL = 32 mm (1.25") for finger and 0 mm (0") for flush electrodes

Figure 3. CMP Fixed Probe

CMP fixed flange probe

The CMP fixed flange probe (Figure 4) is a fixed-length probe. The probe assembly consists of a specified flange that is welded in place, an insertion rod with a three-electrode end cap, a hermetically sealed connector, and a six-pin connector welded in place. The insertion length (I. L.) is calculated to the end of the electrode and must be specified by the customer. This probe is only available with both the remote and direct mounting options.

Electrodes shown in the picture are ordered separately.

Specifications	
Probe Body	1.4435, 316L SS; Hastelloy C
Endcap Seal	Glass
Fill Material	Epoxy
Process Temperature	Direct mount: -50…121 °C (-58…250 °F) Remote mount: -50…260 °C (-58…500 °F)
Pressure Rating	206 bar (3000 psi)
Mounting	Flange connection
Standard Lengths	305, 457, 610 mm (12, 18, 24”)
Custom Lengths	Lengths available in increments of 10 mm (0.5”). Min: 170 mm (7”), Max: 762 mm (30”)
Insertion Length	Fixed, Max = probe length - flange thickness - 50.4 mm (2.0”) + EL, Length specified in 5 mm (0.2”) increments.

*EL = 32 mm (1.25”) for finger and 0 mm (0”) for flush electrodes

Figure 4. CMP Fixed Flange Probe

CMP retractable probe

The CMP retractable probe (Figure 5) is an adjustable-length probe. A specially designed packing gland is used with the probe for insertion into or retraction from a pressurized system without a process shutdown. The packing gland is designed to mount easily on a 1” piping system with a ball valve, but it can be modified for your specific mounting requirements. The probe assembly consists of a packing gland, an insertion rod with a hermetically sealed three-electrode end cap, and a six-pin connector welded in place. A safety chain is also provided to prevent blowout. The insertion length (I. L.) is calculated to the end of the electrode and can be specified by the customer. This probe is only available with the remote mounting option.

Electrodes shown in the picture are ordered separately.

Figure 5. CMP Retractable Probe

Specifications	
Probe Body	1.4435, 316L SS; Hastelloy C
Endcap Seal	Glass
Fill Material	Epoxy
Process Temperature	Remote mount: -50…260 °C (-58…500 °F)
Pressure Rating	102 bar (1500 psi)
Mounting	3/4” NPT fitting
Standard Lengths	610, 762, 914, 1066 mm (24, 30, 36, 42”)
Custom Lengths	Lengths available in increments of 10 mm (0.5”). Min: 170 mm (7”), Max: 762 mm (30”)
Insertion Length	Adjustable, Max = probe length - 165 mm (6.5”) + EL

*EL = 32 mm (1.25”) for finger and 0 mm (0”) for flush electrodes

CMP retractable flange probe

The CMP retractable flange probe (Figure 6) is an adjustable-length probe. A specially designed packing gland is used with the probe for insertion into or retraction from a pressurized system without a process shutdown. The packing gland is welded to a 1" pipe nipple with bleed valve attached to a specified flange, and is designed to mount easily on a matching flange valve. The probe assembly consists of a packing gland, 1" pipe nipple with bleed valve welded to specified flange, an insertion rod with a hermetically sealed three-electrode end cap, and a six-pin connector welded in place. A safety chain is also provided to prevent blowout. The insertion length (I. L.) is calculated to the end of the electrode and can be specified by the customer. This probe is only available with the remote mounting option.

Electrodes shown in the picture are ordered separately.

Figure 6. CMP Retractable Probe

Specifications	
Probe Body	1.4435, 316L SS; Hastelloy C
Endcap Seal	Glass
Fill Material	Epoxy
Process Temperature	Remote mount: -50…260 °C (-58…500 °F)
Pressure Rating	102 bar (1500 psi)
Mounting	Flange connection
Standard Lengths	610, 762, 914, 1066 mm (24, 30, 36, 42")
Custom Lengths	Lengths available in increments of 10 mm (0.5"). Min: 170 mm (7"), Max: 762 mm (30")
Insertion Length	Adjustable, Max = probe length - flange thickness - 255 mm (10") + EL

*EL = 32 mm (1.25") for finger and 0 mm (0") for flush

CMP retrievable probe

The CMP retrievable probe (Figure 7) is a fixed-length probe. It is designed to be used with HPTM and MHTM high-pressure access systems. The probe assembly consists of an insertion rod with a hermetically sealed three-electrode end cap, a hollow plug nut, and a standard six-pin connector, which are all welded in place. The hollow plug nut on the probe screws into the hollow plug of the access system. This allows the probe to be installed in the process, using a retrieval tool and service valve, without process shutdown. The insertion length (I. L.) is calculated using one of the formulas bellow and must be specified by the customer. This probe is only available with the remote mounting option.

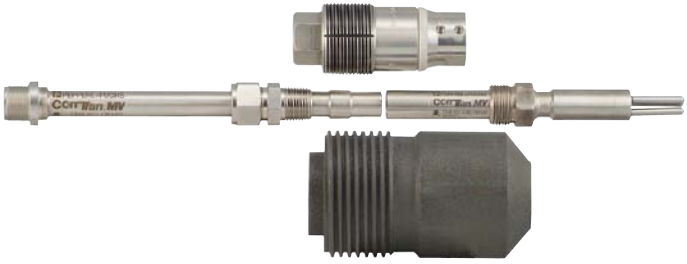
Electrodes shown in the picture are ordered separately.

Specifications	
Probe Body	1.4435, 316L SS; Hastelloy C
Endcap Seal	Glass
Fill Material	Epoxy
Process Temperature	Direct mount: -50…121 °C (-58…250 °F)
	Remote mount: -50…260 °C (-58…500 °F)
Pressure Rating	245 bar (3600 psi)
Mounting	UNS 1-14, 1” left-handed thread
Standard Lengths	Length dependent on insertion length
Insertion Length Finger Electrodes	Top-of-the-line: I.L. = PD + WT + 44.5 mm (1.75”) Middle-of-the-line: I.L. = PD + WT + 22.25 mm (.875”) Bottom-of-the-line: I.L. = PD + WT
Insertion Length Flush Electrodes	I.L. = PD + WT + 44.5 mm (1.75”)

*EL = 32 mm (1.25”) for finger and 0 mm (0”) for flush
*PD = Penetration depth, for flush mount PD = 0
*WT = Wall thickness

Figure 7. CMP Retrievable Probe and Probe Adapter

Hollow plug and access fitting are ordered separately.



3.3 Mounting safety procedures and hints

The CorrTran MV must be installed in locations that are most susceptible to corrosion. In most cases, the highest levels of corrosion tend to occur where water is trapped or stagnant.

The electrodes selected must reflect the same metal properties as the piping or other components susceptible to corrosion. For example, in applications where the pipe is made of stainless steel and the water pump's impeller is made of carbon steel, the impeller will corrode faster than the pipe. In this case, it is advisable to select electrodes that are made of the same material as the pump's impeller.

3.3.1 Mounting requirements / scenarios

Attention

The transmitter should not be mounted in a pipe drop since the corrosive liquid may not be in full contact with the electrodes as shown in Figure 8.

Warning

CorrTran MV should be mounted in the riser of a pipe near an elbow where the velocity is the highest. In general, CorrTran MV should be mounted in pipes or tanks at locations of highest liquid velocity and constant immersion, shown in Figure 9. For velocities greater than 20 fps, the protruding finger electrodes must be protected. As noted above, high fluid velocities can also cause unwanted turbulence in the pipe due to the extension of the probe. Using an adjustable CorrTran MV probe with electrodes mounted flush to the wall of the pipe will eliminate this problem.

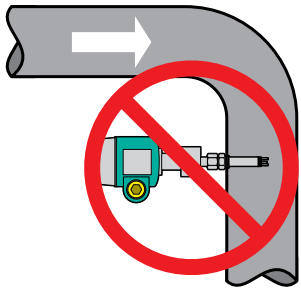


Figure 8. CMC Transmitter Installation

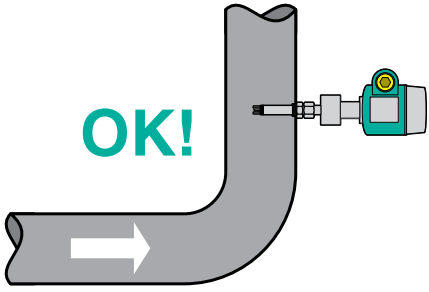


Figure 9. CMC Transmitter Installation

CorrTran MV can be located at any point on the pipeline but should always be immersed in the corrosive material as shown in Figure 10.

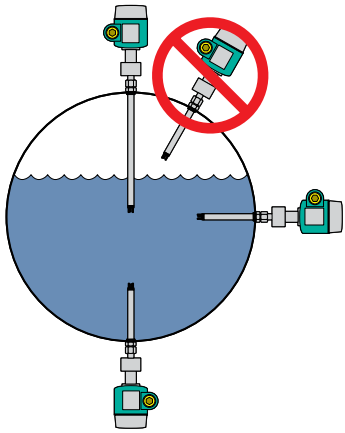


Figure 10. Correct CorrTran MV Pipeline Position

A tee in the condensate return line (Figure 11) is a good location to mount CorrTran MV.

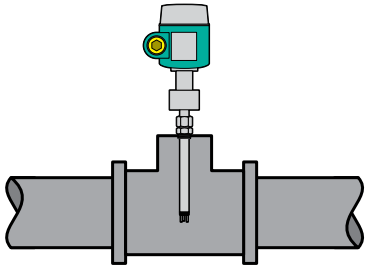


Figure 11. CorrTran MV Located in Tee

CorrTran MV should be located downstream of a control valve for best performance and can also be located in the deadleg portion of a by-pass. Note that the transmitter located in the by-pass leg should be mounted in front of the valve for best performance. As shown in Figure 12. This guarantees that the electrodes will always be immersed in the corrosive material.

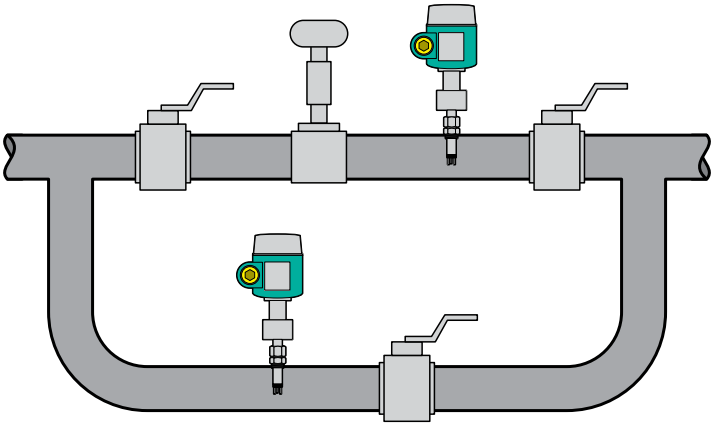


Figure 12. CorrTran MV Located in Bypass Loop

Note

Installing separate CorrTran MV units with different electrode materials on the suction side of the pump will ensure monitoring of the pump impeller and the pipe as shown in Figure 13.

There should be a minimum separation distance of 50 cm (19.7”) between probes.

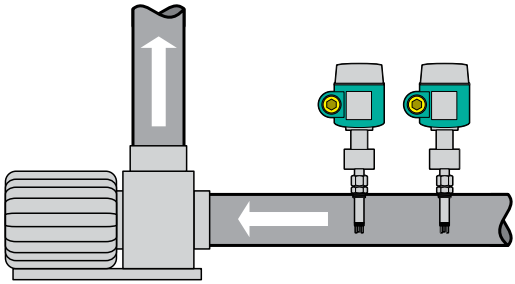


Figure 13. CorrTran MV Mounted With Different Electrodes

In addition to pipes, a condensate flash tank, shown in Figure 14, is also a good application.

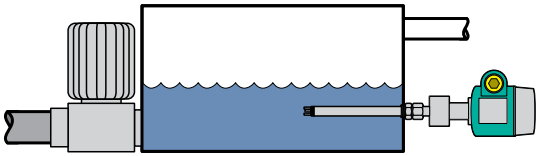


Figure 14. CorrTran MV Installed in a Condensate Flash Tank

The CorrTran MV transmitter is shown in the blow down of a Y-strainer in Figure 15, and the discharge side of the basket strainer is shown in Figure 16.

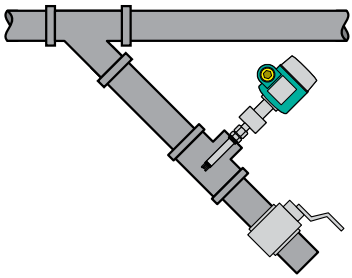


Figure 15. CorrTran MV Mounted in Y-Strainer

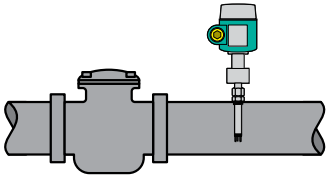


Figure 16. CorrTran MV Mounted in Basket Strainer

Note

It is essential that isolators are installed between the transmitter and the control system if the I/O card is not fully isolated from the ground. See section 4.3 for more information on the proper installation wiring.

3.4 Installation instructions

3.4.1 General

Warning

A trained specialist must perform the necessary installation and commissioning of CorrTran MV. Recognized rules of the technology and setup requirements must be maintained both during and after installation. Safety requirements must be observed during all installation steps.

If the pipe or vessel into which the CorrTran MV is to be inserted is under pressure and/or contains any hazardous substance, such as steam, caustic solutions, acids, toxins or other substances specified by OSHA as physical or health hazards, the pipe or vessel must first be depressurized, any hazardous substance purged therefrom, and appropriate lockout/tagout procedures observed in accordance with Section 1910.147 of the OSHA Regulations, before CorrTran MV can be installed. **Failure to follow these procedures may result in serious injury or death.**

CorrTran MV consists of three basic components:

Transmitter: A transmitter housing contains the electronics and provides the 4-20 mA with HART output signal.

Probe: There are two basic options, direct mount and remote mount. The remote mount probe is supplied with a 6' or 12' cable.

Electrodes: Either finger electrodes or electrodes flush to the probe end are used. Correctly chosen electrodes will corrode in the same manner as the metal being investigated. For accurate measurements, the electrodes must reflect the same metal properties as the metal being investigated.

3.4.2 Electrode installation

The electrodes are shipped loose and must be installed hand-tight. Ensure that the Viton (standard) or Kalrez (on request) gaskets are in place prior to installing the electrodes. See Figure 17 for the electrode installation drawing.

Note

Metal Samples recommends changing the electrodes when they are at 50% of their useful life:

- Finger: 0.4 mm material loss. This means that with an average general corrosion rate of 16 mpy (0.4 mmpy) you would have to replace once a year.
- Flush: 3.175 mm material loss. This means that with an average general corrosion rate of 127 mpy (3.175 mmpy) you would have to replace once a year.

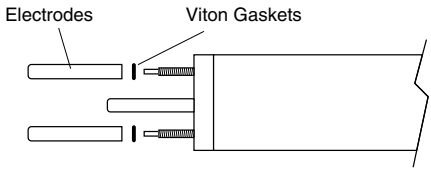


Figure 17. Electrodes and Viton Gaskets

Note

Metal Samples recommends cleaning the electrodes with rubbing alcohol or with another similar solution prior to operation to establish a reliable baseline for the transmitter electronics.

3.4.3 Probe installation

CMP adjustable and fixed probes

1) Insert the probe into the pipe

2) Adjust to desired depth

3) Apply 1-1/4 turns from hand-tight to provide the seal as shown in Figure 18.

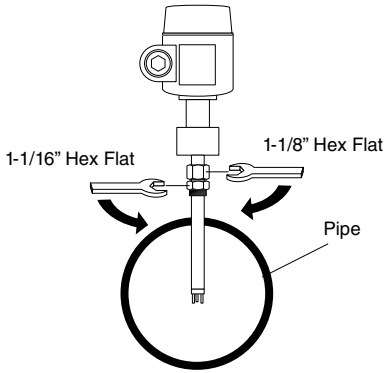


Figure 18. CMP Adjustable and Fixed Probe Mounting

Note

For fixed type probes (without the compression fitting) only the 1-1/16” hex nut needs to be tightened.

Attention

A safety bracket is provided with every adjustable probe and must be installed before the process is put under pressure.

CorrTran MV safety bracket assembly and installation

See Figure 19 for detailed drawings.

1) Screw nut (2) on to threaded rod (3).
2) Screw threaded rod (3) in to base plate (1).
3) Tighten nut (2) to lock threaded rod (3) in place.
4) Slide top plate (4) on to threaded rods (3).
   NOTE: Top plate (4) must be assembled with label on top.
5) Place lock washer (5) and nut (6) on to threaded rod (3).
6) After sensor is mounted in to pipe, slide safety bracket into place and tighten nut (6) to lock bracket into place.

NOTE: If threaded rods (3) are too short for proper adjustment, contact the factory for replacement.

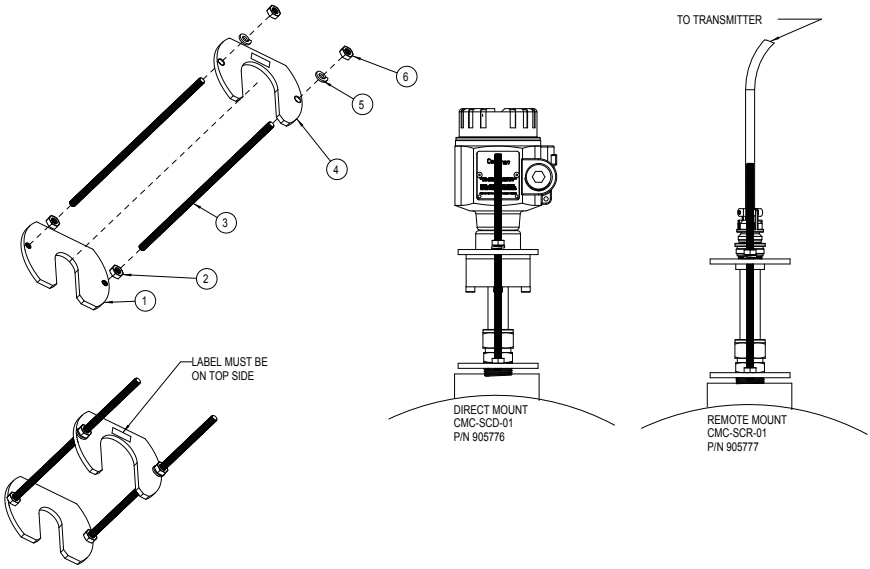


Figure 19. CorrTran MV Safety Bracket Assembly and Installation

CMP fixed flange probes

Insert the probe into the pipe, and tighten to flange specifications.

CMP retractable and retractable flange probes

Note

The packing must be adjusted prior to mounting the packing gland to the process.

See Figure 20 for packing design details.

1) Loosen the locking nut. Slide locking nut and ferrule away form the retainer.
2) Loosen the jam nut. Turn retainer clockwise to tighten packing. The packing should be tightened until there is a resistance felt while sliding the insertion rod in and out. Table 2 summarizes the recommended torque for ambient temperature against water.

Pressure Rating	10.3 bar (150 psi)	34.5 bar (500 psi)	69 bar (1,000 psi)	103.5 bar (1,500 psi)
PTE (Teflon®) Packing	27.1 N-m (240 in-lb)	27.1 N-m (240 in-lb)	33.9 N-m (240 in-lb)	33.9 N-m (240 in-lb)
Grafoil® Packing	20.4 N-m (240 in-lb)	20.4 N-m (240 in-lb)	27.1 N-m (240 in-lb)	27.1 N-m (240 in-lb)

Table 2. Recommended Torque Specifications

Do not over tighten packing. This will result in damage to the gland.

3) Tighten the jam nut, thereby locking the retainer in place.
4) Mount the packing gland on the nipple or flange and secure in place. The rod should be fully retracted at this time with the locking nut and ferrule clear of the retainer.

Attention

The following steps may require a certified pipe fitter for complete installation.

5) Open the process valve and check for packing leaks. If packing is leaking, shut the process valve, remove the packing gland, and readjust the packing gland using steps 3-5.

Note

The packing may be tightened as long as the rod will slide in and out of the gland.

6) Insert to desired length. To lock the rod in place, secure the locking nut and ferrule.
7) Provided safety chain should now be between packing gland and probe body.

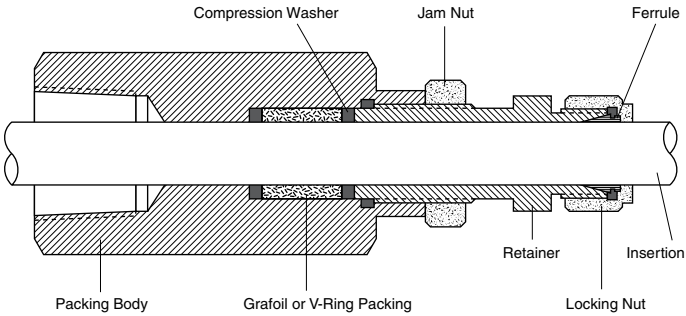


Figure 20. Retractable Probe Packing Design

Attention

If the system is greater than 10.3 bar (150 psi) the use of an “Easy Tool Retracting System” is required to install and remove any retractable packing gland systems.

CMP retrievable probes

Refer to your removeable tool manual for instructions.

3.4.4 Mounting bracket installation

A mounting bracket is available for the remote mount version of CorrTran MV. Its assembly and installation are shown in Figure 21. Please see section 6 for ordering information.

CorrTran MV safety bracket assembly and installation

See Figure 21 for detailed drawings.

1) To assemble locking clamps (5) onto mounting bracket (2), angle clamp (5) out, slide tabs into holes and angle back in.
2) Secure mounting bracket to sensor housing using two screws (6) provided.

For pipe mount:

1) Position mounting bracket (2) on pipe.
2) Using the U-bolt (1) provided, secure the mounting bracket (2) to the pipe using the lock washer (3) and nut (4) provided

For wall mount:

1) Secure mounting bracket (2) to the wall using a sturdy fastener (not provided).

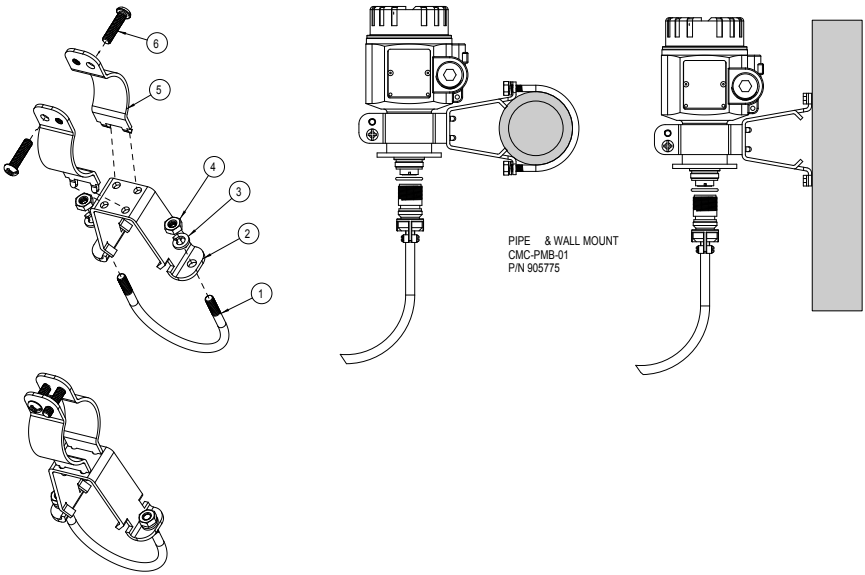


Figure 21. CorrTran MV Mounting Bracket Assembly and Installation

4 WIRING

4.1 Quick wiring guide

Before connection, please note the following:

- The power supply must be identical to the data on the nameplate.
- Switch off power supply before connecting the device.
- Connect equipotential bonding to transmitter ground terminal before connecting the device.

Connect CorrTran MV as follows:

1) Unscrew housing cover.
2) Insert cable through one of the ¾" NPT electrical ports.
3) Make electrical connection. See terminal assignment in Figure 22.
4) Screw on housing cover.

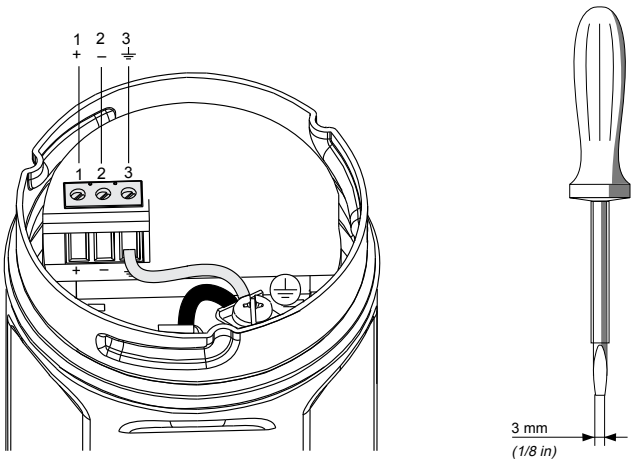


Figure 22. Transmitter Wiring

4.2 HART introduction

Metal Samples' CorrTran MV probe supports the HART communication protocol. HART is an acronym for Highway Addressable Remote Transducer. The HART protocol makes use of the Bell 202 FSK standard to superimpose digital signals at a low level on top of the 4-20 mA signal. This enables two-way communication and makes it possible for additional information beyond just the normal process variable to be communicated to and from a smart field instrument.

4.3 Wiring with HART

Due to the sensitive nature of corrosion measurement, it is important to provide good electrical isolation between the I/O system/power supply and each 4-20 mA/HART signal from CorrTran MV. For this reason, it is essential that isolators be installed between the transmitter and the control system if the I/O card is not fully isolated from the ground. An intrinsic safety isolator used in combination with an intrinsically safe CorrTran MV mounted in a hazardous location meets this requirement, and additional isolation is not required. For all other applications, a signal conditioner capable of repeating the 4-20 mA/HART signals and providing at least 500 V of isolation must be used. If you are using CorrTran MV with a non-HART compatible I/O of data collection device, the KFD2-HLC-Ex1.D, HART Loop Converter, can integrate the three CorrTran MV variables into separate, independent 4-20 mA outputs. Illustrations of these wiring methods can be seen in Figures 23-25.

Please observe the following guidelines:

- **Always use a grounded power supply (on the AC side).**
- **Ensure that the I/O card is isolated from ground.**

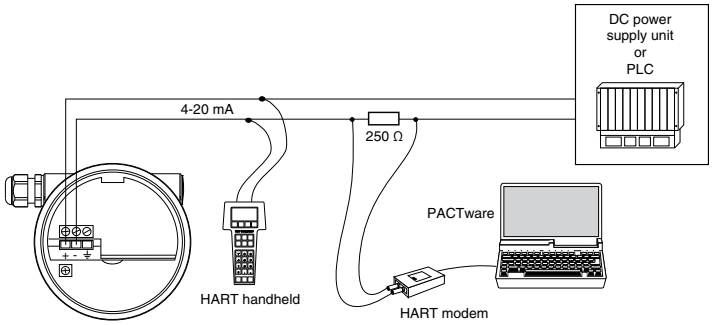


Figure 23. Connecting a HART Modem or a Handheld Device

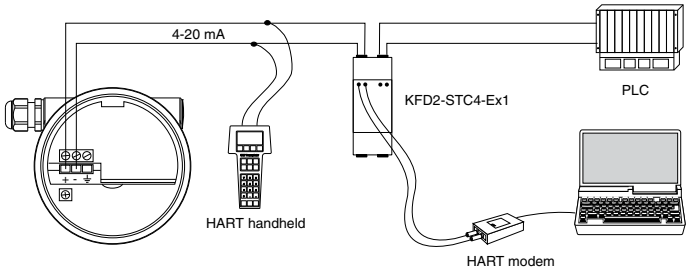


Figure 24. Wiring with IS Barrier or Signal Conditioner

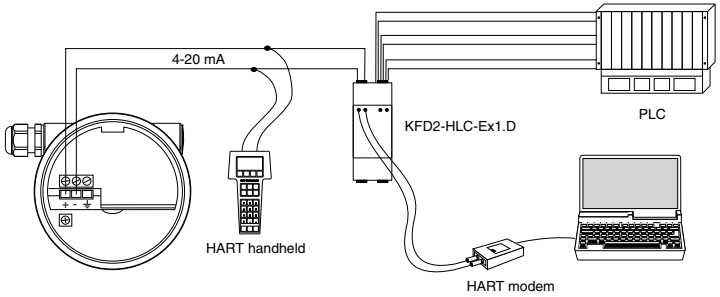


Figure 25. Wiring with the HART Loop Converter

4.4 Post-installation check

After wiring the transmitter and connecting the probes, perform the following checks:

- Is the probe secure and tightened to specified torque? (See section 3.4.3.)
- Have the electrodes been cleaned? (See section 3.4.2.)
- Is the terminal assignment correct? (See section 4.1.)
- Is the housing cover screwed tight?
- Is the signal conditioner installed between the CorrTran MV and the PLC?

5 CONFIGURATION AND COMMISSIONING

5.1 PACTware introduction

PACTware is the latest generation of configuration software that makes it easy to program our equipment. PACTware also interfaces with HART-capable field instruments as well as bus systems such as PROFIBUS, Modbus and ControlNet.

PACTware offers many features that allow users to simplify plant documentation, generate trend curves, and monitor signals using HART data. Our software uses Device Tool Managers (DTM) to provide the interface into PACTware. DTMs have been created for HART-capable instruments by converting their Device Description (DD) into the appropriate DTM for use with PACTware.

5.2 Establishing communication with PACTware

- To establish communication between your CorrTran MV and other devices using PACTware, you must first ensure that your modem is connected and you have access to a recent version of PACTware.
- Connect HART modem as shown in section 4.3.
- Open the latest version of PACTware. Figure 26 shows the main default screen you will see when opening the program. (Please note: The CorrTran MV DTM will work with PACTWare version 2.4 or later.)

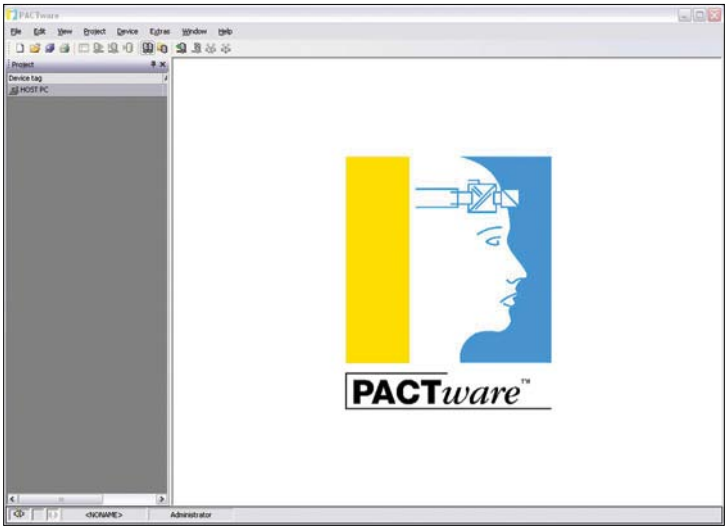


Figure 26. PACTware Main (Default) Screen

5.2.1 Connecting to the host computer

To connect to the host computer with the HART modem:

- Highlight the HOST PC.
- Right click and select ‘Add device’ from the toolbar and add the ‘HART Communication’ FDT as shown in Figure 27.

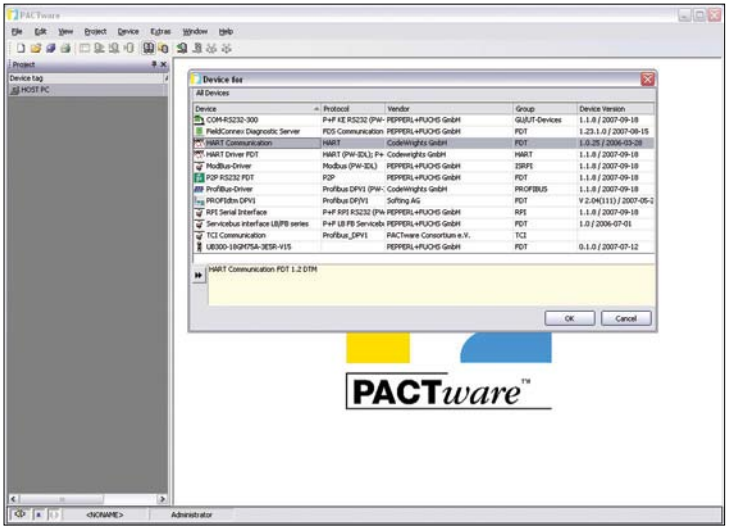


Figure 27. 'HART Communication' FDT

5.2.2 CorrTran MV connection

To establish a connection with your CorrTran MV unit(s):

- Highlight the HART Communicator.
- Right click and select 'Device' > 'Add device' from the toolbar and add the 'CorrTran MV' DTM. Your screen should appear as shown in Figure 28.

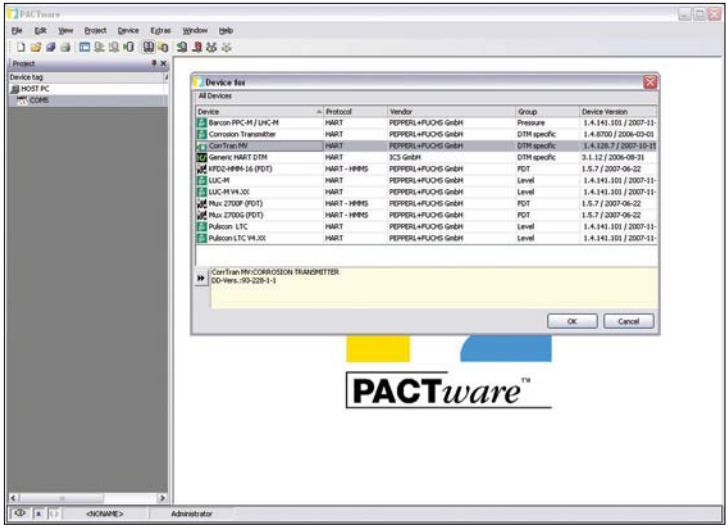


Figure 28. 'CorrTran MV' DTM

5.2.3 Assigning the HART modem to the correct com port

When loaded into PACTware, the HART modem defaults to Com 3 and will very likely need to be changed when using RS-232 or USB port modems.

USB connections will show up as com ports in the PACTWare environment. If you are not sure what com port your modem is using, go to your computer's device manager by opening the following windows:

- 'Control panel' > 'System' > 'Hardware' > 'Device Manager'
- Expand the 'Ports (COM & LPT)' to find out which com port is being used by the modem USB, as seen in Figure 29.

To change the com port on the HART Communication:

- Double click on COM3 on the left side of screen.
- Change to the proper com port, as seen in Figure 30, and click on apply. (Please note: RS-232 ports are usually com 1.)

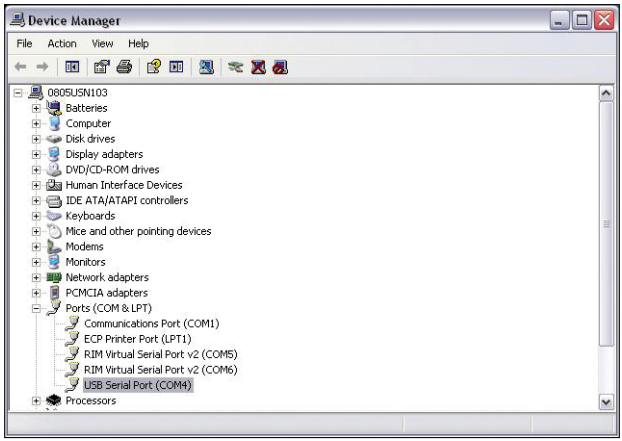


Figure 29. Device Manager Ports (COM & LPT)

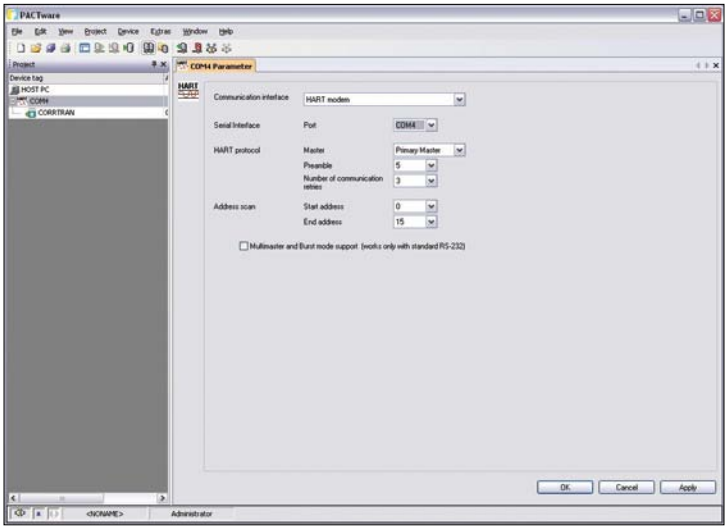


Figure 30. HART Modem USB Connected to a Different COM Port

5.2.4 Connection to the CorrTran MV unit.

- Highlight the 'CORRTRAN' to the left of the screen.
- Right click and select 'Connect' from the toolbar. Wait several seconds and the COM Parameter tab will display a '#' symbol, and a green check mark will appear in the bottom left indicating that the CorrTran MV has established communication with PACTware, as seen in Figure 31.

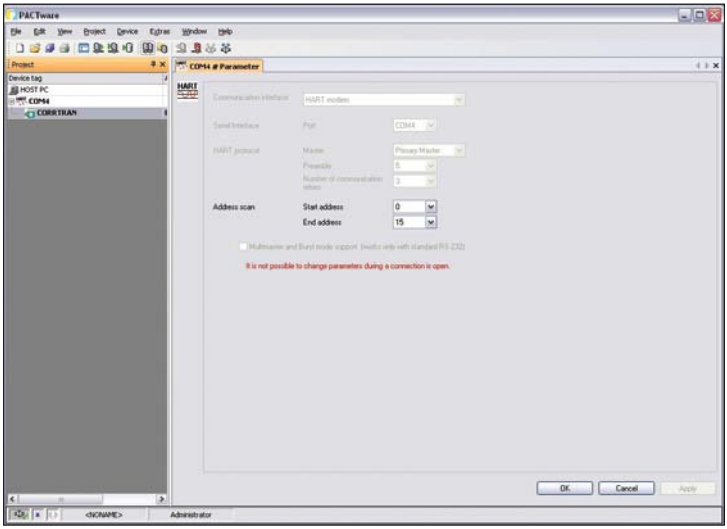


Figure 31. CorrTran MV Connected to PACTware

5.3 CorrTran MV online variables and parameters

Once a connection has been established, information from the CorrTran MV transmitter can be gathered.

5.3.1 Connection to online parameters

To get online parameters:

- Highlight the 'CORRTRAN' to the left of the screen.
- Right click and select 'Parameters' > 'Online Parameterization' from the toolbar. Your screen should appear as shown in Figure 32.

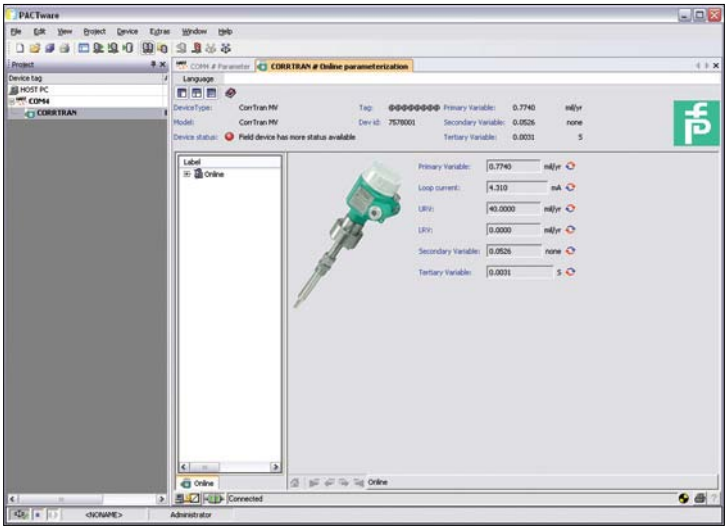


Figure 32. CorrTran MV Online Parameters (read only)

You can expand the online parameters to set up and show the configurations and other operational parameters important to your application.

5.3.2 Online parameters: process variables

The PACTware 'Process variables' windows are read only and show the configurations associated with CorrTran MV's three process variables. Each process variable has its own detailed screen, listed in the tree as 'PV', 'SV', and 'TV':

- **PV – Primary Variable:** The primary variable screen includes percentage of range, loop current, average, and the sample count, which is how long the CorrTran MV has been powered in commission. Figure 33 shows a screen shot of the 'PV' page.
- **SV – Secondary Variable:** This screen shows what the secondary variable is, its average, and the sample count.
- **TV – Tertiary Variable:** This screen provides information about the tertiary variable, which is set to measure conductance and cannot be changed. On this screen, you will see conductance measured in Siemens, along with its sample count.

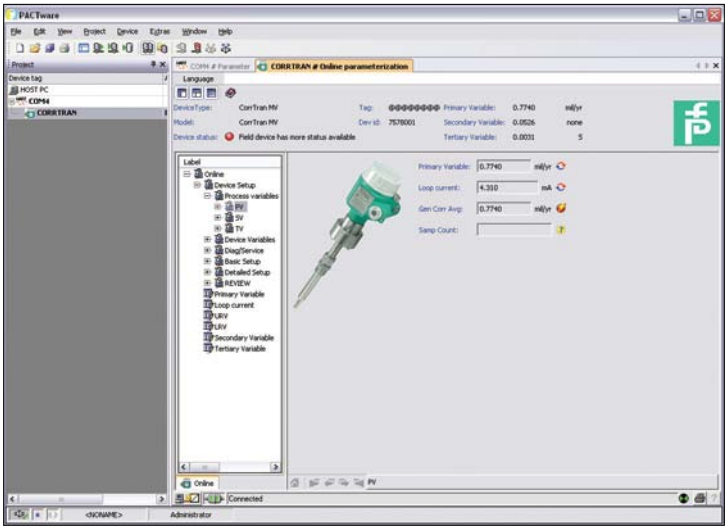


Figure 33. Process Variables – Primary Variable (read only)

5.3.3 Online variables: diag/service

The 'Device Variables' screen, as shown in figure 34, provides an overview of all three process variables. This screen is read only.

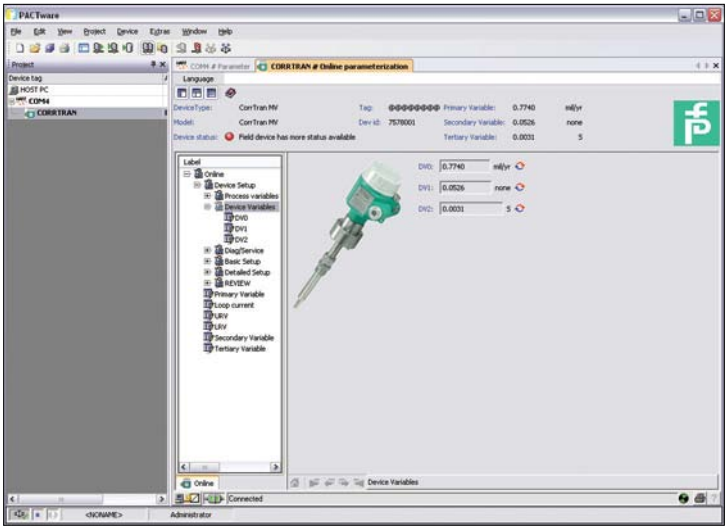


Figure 34. Device Variables (read only)

5.3.4 Online variables: device variables

The Diagnostics/Service feature is password protected by default. To utilize this feature, you must enable the password as seen in Figure 35. The default password is 'managers', and can be changed after the password has been enabled. After the password is enabled, you will see the screen shown in Figure 36.

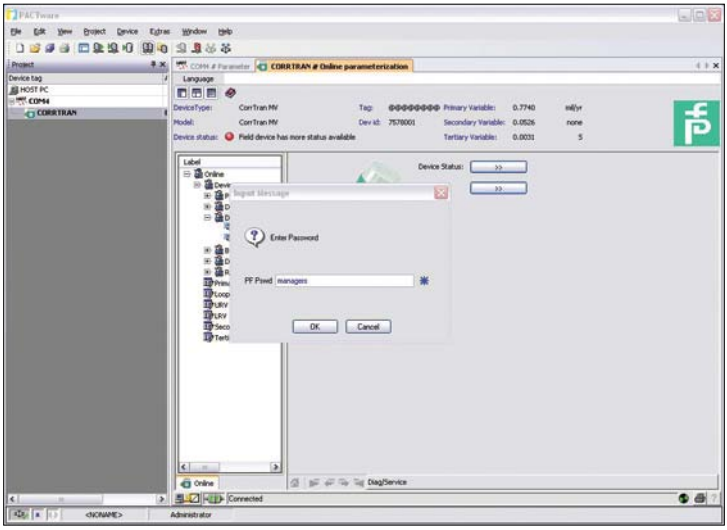


Figure 35. Enabling the Password

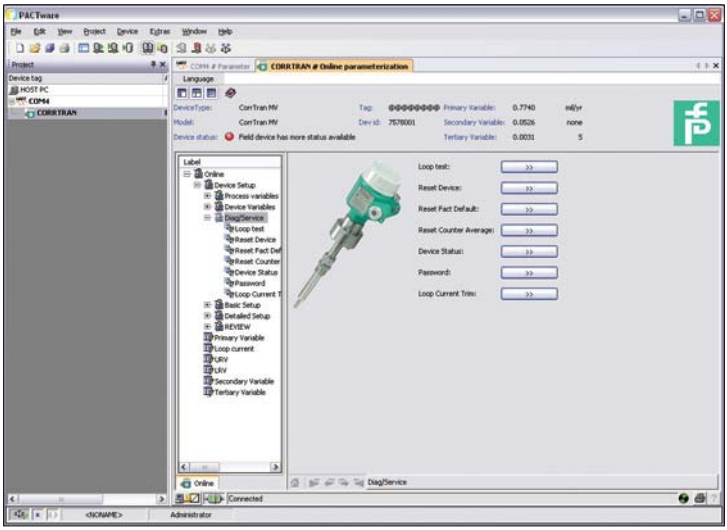


Figure 36. Diag/Service Password Enabled

From the ‘Diag/Service’ menu, you have access to the following features:

- ‘Loop test’: allows you to impress a current signal on the output of the transmitter.

Attention

If the transmitter is being used for control, then it should be disabled. The Current selected for output will be imposed onto the loop.

- ‘Reset Device’: recycles power.
- ‘Reset Fact Default’: resets parameter and passwords to factory default settings.
- ‘Reset Counter Average’: resets sample count and average to zero and the PV and SV are set to zero.
- ‘Device Status’: indicates any parameters that are out of range or not working properly. All the device status error codes are defined and expanded upon in Section 8, Troubleshooting, Table 4.

Note

If device status circle, located at the top section of the PACTware screen, is green CorrTran MV currently has no errors. If the circle is red, CorrTran MV currently has an error that can be viewed by clicking the ‘Device Status’ button. See Figure 37 to locate the device status circle.

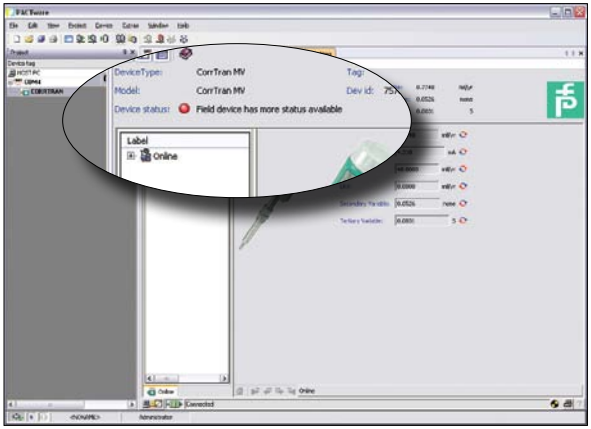


Figure 37. Device Status

- ‘Password’: allows you to change, disable/enable, or exit the password.
- ‘Loop Current Trim’: does not normally need to be trimmed and is done at the factory. Consult factory if this is required.

5.3.5 Online variables: basic setup

The ‘Basic Setup’ windows allow basic configuration for the following parameters:

Note

The password must be enabled in order to configure the CorrTran MV.

- ‘Device Information’: allows you to enter information about your CorrTran MV. Some of the fields, such as model and manufacturer, are read only.

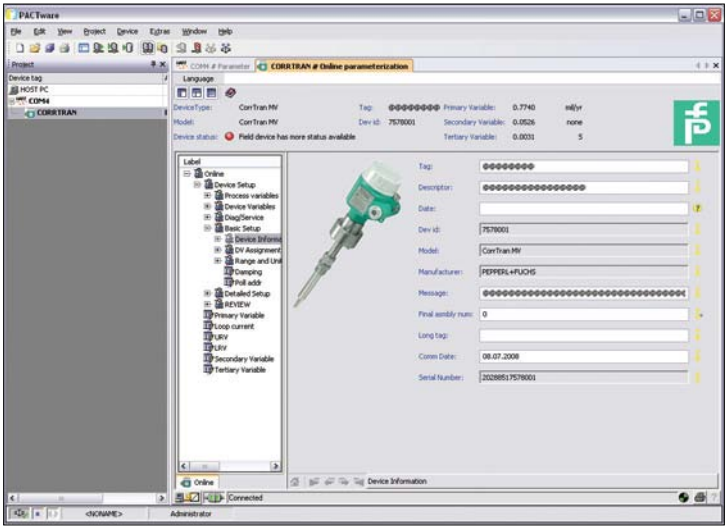


Figure 38. Basic Setup – Device Information

- ‘DV Assignment’: allows you to configure the Primary (PV) and Secondary (SV) Variables as either general or localized corrosion, respectively. Remember, the Tertiary Variable (TV) is always conductance and cannot be changed. Figure 38 shows the ‘DV Assignment’ screen in the ‘Basic Setup’ menu.

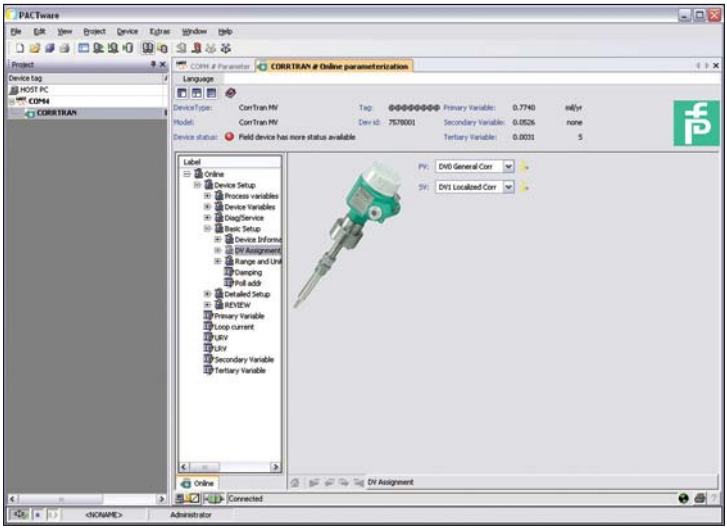


Figure 39. Basic Setup – Device Variable Assignment

- ‘Range and Units’: allows you to configure the PV units and range, when general corrosion is assigned as the PV. Figure 39 displays the ‘Range and Units’ window.

Note

When localized corrosion is assigned as the PV, no units or range are selectable because localized corrosion is unitless and is on a scale from 0 to 1, with 0 being no localized corrosion and 1 being very high.)

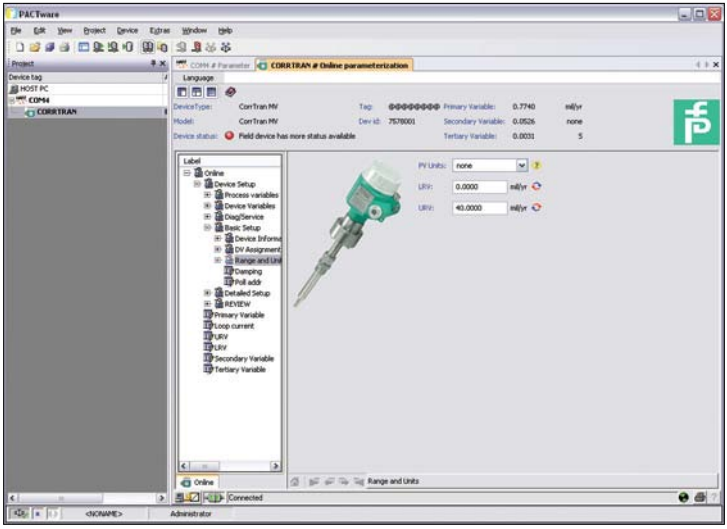


Figure 40. Basic Setup – Range and Units

- ‘Damping’ and ‘Poll addr’: are listed as two menu items, but actually appear on one screen. Damping is defaulted to 0.01 seconds, but does not affect the readings because the measurement cycle can range from 4 to 21 minutes.

5.3.6 Online variables: detailed setup

The data needed to complete the ‘detailed setup’ window is entered at the factory before the CorrTran MV is shipped, but you may need to reenter or change information in this window if the electrodes are changed to a different material or general or localized corrosion are eliminated from the measurement for faster update times. Figure 40 shows the ‘Detailed Setup’ configuration window.

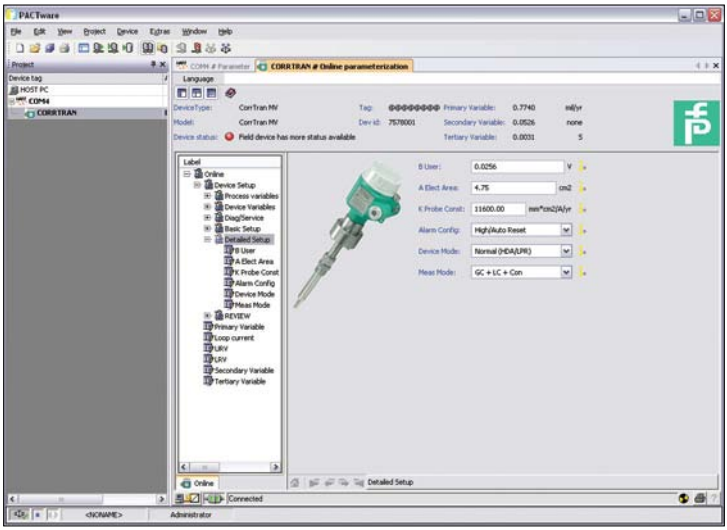


Figure 41. Detailed Setup

Under the ‘detailed setup’ menu, you can update values in the following windows:

- ‘B User’: B User refers to the B value or Stern-Geary voltage, which is defaulted to 25.6 mV. B User is only relevant in LPR only mode. This value does not normally need to be changed.
- ‘A Elect Area’: This window allows you to change the electrode area, which is required for the corrosion calculation. The surface area is defaulted to 4.75 cm^2 for the finger type electrodes. Flush mount electrodes are defaulted to 0.316 cm^2.
- ‘K Probe Const’: refers to the K probe constant, or corrosion constant K. This value is dependent on the pipe’s metal properties and is required for the calculation process.

The default is 11597.63 $\frac{mm * cm^2}{year * cm^2}$

$$K = \frac{3270.22 * (\text{atomic mass of metal in grams})}{(\#\text{ of electrons in the corrosion reaction}) * (\text{density in g/cm}^2)}$$

Note

See Table 5 in the Appendix for factory calculated K values of common electrode materials.

- 'Alarm Config': This screen controls the settings for an alarm that activates when the PV corrosion rate goes above or bellow the URV or LRV. The default is High/Auto, and the options are as follows:
- No Alarm – Alarm is turned off
- High/Auto – Output goes to 22.5 mA and resets automatically.
- High/Manual – Output goes to 22.5 mA and resets manually.
- 'Device Mode': This determines the way the general corrosion calculation is performed by the CorrTran MV.
- Normal (HDA/LPR) – A process-specific Stern-Geary voltage (Bharm) is calculated with every measurement cycle through HDA. This value is then implemented in the LPR corrosion rate calculation. This is the default setting and should be left intact to maintain the best accuracy.
- LPR only – A user defined Stern-Geary voltage ('B User') is specified and used for all LPR corrosion rate calculations.
- 'Meas Mode': Certain corrosion measurements can be turned off to give a faster response if not required for the calculation. The two variables that can be switched off are general corrosion (GC) and localized corrosion (LC). Conductance is required for both corrosion types and cannot be turned off. If all three are used, the default is GC + LC + Cond. The three possible configurations and cycle times are:
- GC + LC + Cond. – General, Localized, Conductivity: 21 minute cycle
- GC + Cond. – General, Conductivity: 4 minute cycle
- LC + Cond. – Localized, Conductivity: 17 minute cycle

5.3.7 Online variables: REVIEW

'REVIEW' allows you to review all the set up parameters for the CorrTran MV transmitter previously discussed. Clicking on either the main 'REVIEW' or submenu items below it will display the screen seen in Figure 41.

The actual measured B value (Stern-Geary value) is indicated at the bottom as the 'Calculated B value'

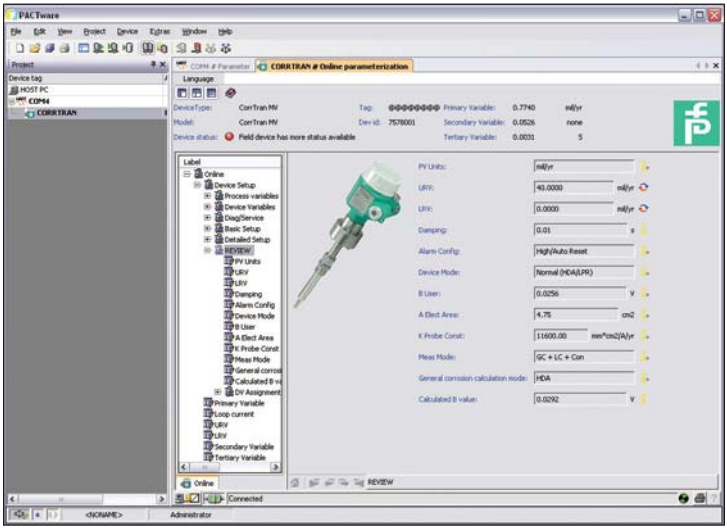


Figure 42. Review (read only)

5.3.8 Additional functions: process trend

To get 'Process Trend':

- Highlight the 'CORRTRAN' to the left of the screen.
- Right click and select 'Additional Functions' > 'Process Trend' from the toolbar. Your screen should appear as shown in Figure 42.

'Process Trend' allows you to plot all three variables (general corrosion, localized corrosion, and conductance) on the same graph over a user defined period of time.

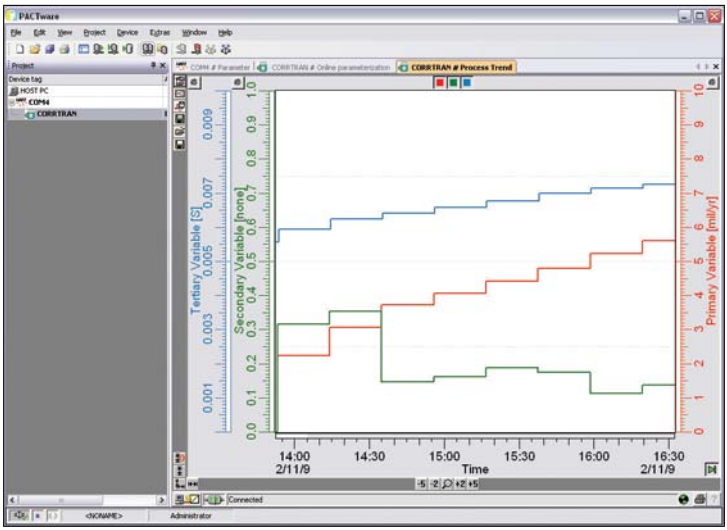


Figure 43. Process Trend

5.4 CorrTran MV test probe: CMP-TESTER

Note

Note: Using the CMP-TESTER is optional and not required for configuring and commissioning the CorrTran MV

Note: The CMP-TESTER is designed as a tool to verify proper functionality of the CorrTranMV. It is not a calibration device, and can not be used to scale the corrosion process data.

- Disconnect the CorrTran MV transmitter from the probe or the remote mount cable.
- Attach the CMP-TESTER to the transmitter as seen in Figure 44.
- In Pactware or using the Evaluation Tool set CorrTran parameters as follows:

  Device Mode = LPR Mode
  B Value = 25.6 mV

- Allow the CorrTran MV to complete one whole sampling cycle.

CorrTran MV test probe

- From the PACTware CorrTran MV REVIEW screen (see page 40) collect the following data:
  A Elect Area
  K Probe Const
  Calculated B Value
- From the PACTware CorrTran MV Online Parameters screen (see page 32) read the corrosion rate in mil/yr.
- For A Elect Area = 4.75cm^2 (finger style electrodes) use Equation 1
- For A Elect Area = 0.316cm^2 (flush style electrodes) use Equation 2

Equation 1: CRcalc = B/12695 • (K-7)

Equation 2: CRcalc = B/846 • (K+1.4)

Where:

CRcalc is the calculated corrosion rate in mil/yr, B is the Calculate B value, and K is the K probe constant.

If the CRcalc is +/- 1% of the corrosion rate obtained from the PACTware CorrTran MV Online Parameters screen, then CorrTran MV is operating within factory specifications. At this point remove the CMP-TESTER and reattach the transmitter to the probe or the remote mount cable.

6 REPLACEMENT PARTS AND ACCESSORIES

6.1 CorrTran MV parts

Please submit the serial tag number on the nameplate when ordering replacement parts for CorrTran MV.

Warning

If the pipe or vessel into which the CorrTran MV is to be inserted is under pressure and/or contains any hazardous substance, such as steam, caustic solutions, acids, toxins or other substances specified by OSHA as physical or health hazards, the pipe or vessel must first be depressurized and any hazardous substance purged therefrom, and appropriate lockout/tagout procedures observed in accordance with Section 1910.147 of the OSHA Regulations, before CorrTran MV can be removed or the electrodes replaced. Failure to follow these procedures may result in serious injury or death.

6.1.1 Transmitter replacement

C M T M - A 2 I H ☐ - ☐☐

Certificates
D2 cCSAus, NI, Cl. I,II,III; Div. 2, Group A-D
Ex cCSAus, EX, Cl. 1; Div. 1,2; Group A-D
GP gneral purpose
IS cCSAus, IS, Cl. I, II, III; Div. 1, 2; Group A-D
Ex II 1G EEx ia IIC T4

Transmitter Mounting
1 direct mount
2 remote mount (cable not included)

Electrical Output
IH 4-20 mA, HART

Housing
A2 aluminum housing, Nema 4x, 3/4" NPT

Corrosion Type
M Multivariable

6.1.2 Probe replacement

C M P - ☐☐☐ ☐☐ ☐ ☐☐☐ - ☐☐ / ☐☐☐

Insertion Length (fixed probes only)
in inches, 5" … 28", in 0.2" increments

050	5.0"
052	5.2"
…	
278	27.8"
280	28.0"

in mm, 130mm … 710mm, in 5mm increments

130	130mm
135	135mm
…	
705	705mm
710	710mm

Electrode Material
0A… see electrode material guide
*only needs to be specified for flush mounted electrodes

Probe Length

050*	5", 3/4" NPT
080	8", 3/4" NPT
110*	11", 3/4" NPT
120	12", 3/4" NPT or Flange
180	18", 3/4" NPT or Flange
240	24", 1" NPT, 3/4" NPT, or Flange
300	30", 1" NPT, 3/4" NPT, or Flange
127*	127 mm, 3/4" NPT
204	204 mm, 3/4" NPT
280*	280 mm, 3/4" NPT
305	305 mm, 3/4" NPT or Flange
457	457 mm, 3/4" NPT or Flange
610	610 mm, 1" NPT, 3/4" NPT, or Flange
762	762 mm, 1" NPT, 3/4" NPT, or Flange
ADP	Retrievable Probe Electrical Adaptor

*epoxy probe only

Probe Mounting
See probe mounting guide

Measurement Unit, Probe Material

CB	inches, 1.4435, 316L
CC	inches, hastelloy C
CF	inches, epoxy glass
DB	mm, 1.4435, 316L
DC	mm, hastelloy C
DF	mm, epoxy glass
HF	HF applications, no glass seal
CS	Special, consult factory

Process Connection

A31	1", flange ANSI B 16.5, 150 lbs
A32	1", flange ANSI B 16.5, 300 lbs
A61	2", flange ANSI B 16.5, 150 lbs
A62	2", flange ANSI B 16.5, 300 lbs
F61	DN40 PN6 Form B Flange
F65	DN40 PN40 Form B Flange
N21	3/4" NPT, ANSI B 1.20.1, 1.4435/316L
N2P	3/4" NPT, ANSI B 1.20.1, adj. thread, nylon
N31	1" NPT
U31	UNS 1-14, 1" left handed thread
XXX	Special Version

*Consult factory for other available options

**Probe Mounting Guide and Electrode Material Guide can be found in the Appendix*

6.1.3 Electrode replacement – finger electrodes

C M C - □□

Electrode Material
0A… see electrode material guide

**Electrode Material Guide can be found in the Appendix*

Note

Electrodes are sold in a pack of 3.

6.1.4 Remote mount cable replacement

C M C - R / 0 2 - □

Cable Length
6 remote mount with 1.8m (6') cable
12 remote mount with 3.6m (12') cable

6.2 HART accessories

For installations requiring more then one transmitter, we offer a wide variety of HART multiplexers and termination boards for wiring to a PLC or DCS system. The multiplexers are available in 16 and 32 channel options.

Model	Description
KFD2-HMM-16	16-channel MUX master
KFD0-HMS-16	16-channel slave

Please contact Metal Samples for termination board selection.

6.3 Surge protection and IS barriers

Using an intrinsically safe transmitter in a hazardous area requires an IS barrier. The following styles of isolated barriers are offered:

Model	Description
KFD2-HLC-Ex1.D	IS HART loop converter with 3 distinct 4-20 mA outputs
KCD2-STC-Ex1	1-channel IS isolator
KFD2-STC4-1	1-channel non-IS signal conditioner
KFD2-STC4-1.20	1- input 2- output non-IS signal conditioner
KFD2-STC4-Ex1	1-channel IS isolator
KFD2-STC4-Ex2	2-channel IS isolator
KFD2-STC4-Ex1.20	1- input 2- output IS isolator
KFU8-CRG-1.D	4-20 mA non-IS limit alarm
KFU8-CRG-Ex1.D	4-20 mA IS limit alarm

For installations requiring surge or lightning protection, use the above barriers in conjunction with one of these surge barriers:

Model	Description
K-LB-1.30	1-channel Safe Zap surge barrier
K-LB-2.30	2-channel Safe Zap surge barrier
FN-LB-I	1-channel, screw-in type surge barrier for field mounting

6.4 Additional accessories

Model	Description
905820	Safety label
US-HI-321	USB HART modem
CMC-SCD-01	Safety bracket for direct mount probes
CMC-SCR-01	Safety bracket for remote mount probes
CMC-PMB-01	Wall or pipe mounting bracket for remote mounted transmitters
CMD-DL-Ex1	Safe area mountable data logger
CMD-DR2-Ex1	Zone 2 mountable video-graphic data recorder
CMC-SR2159ER36	36” easy tool retraction system for use with retractable probes
CMP-TESTER	CorrTran MV test probe

*Consult factory for information on access fittings, the retrieval tool, and the service valve for use with retrievable probes

*Consult factory for information on pipe nipples and ball valves for use with the installation and mounting of retractable probes.

7 SYSTEM SPECS

Application

The CorrTran MV performs continuous (electro-chemical) corrosion measurement of liquids and gasses. Probes are available in several different materials and process connections:

- Epoxy glass probe: 3/4” NPT adjustable nylon fitting
- Adjustable probe: 3/4” NPT fitting, available in 316L SS and Hastelloy C
- Fixed probe: 3/4” NPT fitting and flanges starting at 1” ANSI B 16.5 150 lbs, available in 316L SS and Hastelloy C
- Retractable probe: Adjustable, 1” female NPT fitting and flanges starting at 1” ANSI B 16.5 150 lbs, available in 316L SS and Hastelloy C
- Retrievable probe: Fixed, UNS 1-14 1” left hand thread, available in 316L SS and Hastelloy C

Function and System Design

Measuring Principle:The CorrTran MV utilizes state-of-the-art algorithms and data analysis techniques to accurately measure general corrosion rate and pitting. To improve the performance of the industry-accepted Linear Polarization Resistance (LPR) technique, the Harmonic Distortion Analysis (HDA) is used to calculate and update a process-specific Stern-Geary variable (Bharm) every measurement cycle. To further enhance the performance, an application-specific Stern-Geary variable (B-value) is calculated and updated every measuring cycle. There is no need to manually update the B-value because of process changes. During the measurement cycle, CorrTran MV also performs an automated Electrochemical Noise (ECN) measurement that provides a localized corrosion (pitting) measurement. At the completion of each measurement cycle, the respective corrosion rate and pitting value in the form of a 4-20 mA/HART signal is produced and made available to plant personnel.

Equipment Architecture

See page 26, section 4.3 Wiring with HART.

Technical data

Input	
Measured Variable	• General corrosion: Electro-chemical corrosion that proceeds more or less uniformly over the surface of the material exposed to the corrosive environment. • Localized corrosion (pitting): Electro-chemical corrosion that occurs at discrete sites on the material exposed to the corrosive environment. • Conductance: The reciprocal of the solution resistance. It is a measure of how easily electricity flows along a certain path through an electrical element.
Measuring Range	• General corrosion: 0 ... 1000 mpy (0 ... 25 mmpy), 0 ... 40 mpy (0 ... 1 mmpy) default value • Localized corrosion (pitting): Unitless number from 0 ... 1, with 0 being no localized corrosion and 1 being very high. • Conductance: Not adjustable. Measured in Siemens.
Output	
Output Signal	• 4-20 mA with HART protocol, 2-wire
Signal on Alarm	Error information can be accessed via the following interfaces: • Current output, 22.5 mA • Digital interface
Auxiliary Energy	
Electrical Connection	Housing F 12 with additionally sealed terminal compartment for standard, EEx ia, Intrinsically Safe (IS), or Nonincendive (NI)
Load HART	Minimum load for HART communication: 250 Ω
Cable Entry	See page 25, Section 4.1 Quick Wiring Guide
Supply Voltage	11-30 VDC
Rated Operating Voltage	11 VDC min at max loop current
Connectable Load	Max. load at 24 VDC: 575 Ω with high alarm / 650 Ω without high alarm
B-Value (Start-up)	25.6 mV
Performance Characteristics	
Reference Operating Conditions	• Temperature: -50 °C to +70 °C (-58 °F to +158 °F) • Pressure: 240 bar (3600 psi) • Solution Conductance: Min 4 µS • General Corrosion Rate: 0 ... 1000 mpy (0 ... 25 mmpy)
Accuracy	• Voltage measurement and electrode excitation: <0.02% • Current measurement: <0.1%

Technical data (continued)

Operating Conditions	
Operating Conditions	
Installation Instructions	See page 20, Section 3.4 Installation Instructions
Environment	
Ambient Temperature Range	Ambient temperature for the transmitter: • GP, NI, IS version: -50 °C to +70 °C (-58 °F to +158 °F) • EX version: -40 °C to +70 °C (-40 °F to +158 °F)
Storage Temperature	-40 °C to +70 °C (-40 °F to +158 °F)
Degree of Protection	• Housing: IP66, NEMA 4X
Vibration Resistance	10…1000 Hz, 0.2 g^2/Hz acc. to DIN EN 600068-2-64
Cleaning of the Probe and Electrodes	See page 20, Section 3.4.2 Electrode Installation
Electromagnetic Compatibility	NAMUR NE21; EN 61326, 1999 Immunity standards meet EN61000 sections 3-2, 3-3, 4-2, 4-3, 4-4, 4-5, and 4-11
Process Conditions	
Process Temperature Limits	See technical specifications for your probe, Section 3.3 Probe Specifications
Process Pressure Limits	See technical specifications for your probe, Section 3.3 Probe Specifications
Process Flow Rate Limits	• Finger electrodes: Max 6.1 mps (20 fps) • Flush electrodes: No limit on electrodes; dependent on mechanical strength of probe body in the flow.
Mechanical Construction	
Design, Dimensions	See page 7, Section 3.1 Dimensions
Weight	Approx. 500 g (16.1 oz), transmitter housing
Material	• Housing: Aluminum • Process Connections: 1.4401/316L SS, Hastelloy C, or Nylon • Probe: 1.4401/316L SS, Hastelloy C, or epoxy glass; fill material epoxy • End cap seal: Glass (standard) or epoxy (on request) • Electrode: See Electrode Material Guide • O-ring: Viton (standard) or Kalrez (on request)
Process Connection	See page 5, Section 2.1.2 Key to Model Number
Human Interface	
Operation Concept	See page 26, Section 4.3 Wiring with HART. See page 28, Section 5 Configuration and Commissioning
Certificates and Approvals	
CE Approval	The measuring system meets the legal requirements of the EC-guidelines.
External Standards and Guidelines	EN 60529 protection class of housing (IP-code) EN61010 safety regulations for electrical devices for measurement, control, regulation, and laboratory use. EN61326 emissions (equipment class B), compatibility (appendix A – industrial area)

Technical data (continued)

CSA Approval	cCSAus certified for US and Canada; Certificate #1563164: • IS: Cl. I, II, III; Div. 1, 2; Groups A…G • NI: Cl. I, II, III; Div. 2: Groups A…G • EX: Cl. I; Div. 1,2; Groups A…D
IEC Approval	
Patents	U.S. patents: 7,239,156; 7,245,132; 7,265,559; 7,282,928
Ordering Information	
Ordering Information	Metal Samples can provide detailed ordering information and information on the order codes on request
Accessories	
Accessories	See page 42, Section 6 Replacement Parts and Accessories
Supplementary Documentation	
Supplementary Documentation	“Detecting and Interpreting Localized Corrosion Using CorrTran MV”

8 TROUBLESHOOTING

If you encounter problems configuring or using your CorrTran MV, consult the following troubleshooting table. If you continue to have problems, please contact your Metal Samples representative for further assistance.

Symptom	Cause/Procedures	Solution
No 4-20 mA output	Check voltage and compare it with the specifications on the nameplate.	Connect the correct voltage
Measuring correct voltage but unit does not respond	Check polarity on the terminals.	See section 4.1
HART communication does not function	The communication resistor is not installed properly.	See chapter 4.3: Wiring with HART

Table 3. CorrTran MV Basic Troubleshooting Guide

Device Status Codes	Description	Troubleshooting
PV out of limits	The primary variable has exceeded either the LRV or URV.	This can only happen if General Corrosion is assigned to the PV and the ranges are not set properly. Extend the range values to include current data point. See section 3.3.2 for more information.
SV or TV out of limits	The secondary or tertiary variable has exceeded either the LRV or URV	This can only happen if General Corrosion is assigned to the SV and the ranges are not set properly. Extend the range values to include current data point. See section 3.3.2 for more information. The TV cannot be out of limits because it has no limits.
Analog output saturated	The analog output has reached either its minimum or maximum	This can only happen if the alarm mode is off and the PV exceeds its LRV or URV.
Analog output fixed	The analog output signal has been set to a fixed mA value.	This is a result of setting the Loop Current to a fixed value on the tools tab. See section 3.3.4 for more information.
More status available	This flag indicates that one or more of the flags in the More Field Device Status section are set	Information only.
Cold start	This flag is set after power has been recycled for one communication transaction.	Information only.
Configuration changed	A change has been made to the CorrTran MV configuration.	This can be reset by pressing the Reset Config Changed Flag on the device status tab. See section 3.3.3 for more information.
Device malfunction	This flag indicates that one or more of the flags in the Device Malfunction section are set.	Information only.

Table 4. Device Status Codes Troubleshooting Guide (continued on next page)

Device Status Codes	Description	Troubleshooting
LPR only mode	The CorrTran MV has been configured to operate in LPR mode for its general corrosion calculation.	Device mode is by default Normal (HDA/LPR) and should be left that way to maintain the best accuracy for all process variables. See section 3.3.2 for more information.
High localized corrosion detected	The localized corrosion rate is above 0.3.	Information only.
B value from Harm. Out of range	The calculated B value based on the HDA is out range (10mV<B<62.5mV).	In some rare occasions the HDA calculation might not give a plausible result. Switch to LPR only mode if this flag persists to stay on. See section 3.3.4 for more information.
Conductance out of range	The measured solution conductance is lower than 4 µS. This equals a conductivity of approximately 1 µS/cm for finger electrodes.	The CorrTran MV needs at least 4 µS of solution conductance or solution conductivity of 1 µS/cm for full accuracy. This can also be an indication that there is too much build up on the surface of the electrodes and they may need to be cleaned or they may not be fully immersed in the process fluid.
Cell offset voltage overflow	The CorrTran MV has detected a voltage difference between the three electrodes which is too high to compensate.	Typically this is an indication that there is too much build up on the surface of the electrodes and they need to be cleaned or that they have exceeded their useful life and should be replaced.
Corrosion rate calculation not possible	The CorrTran MV was not able to get any useful data.	Check the electrodes for debris, check for other flags, and make sure that the electrodes are fully immersed.
Electrode balance out of range	Due to an extremely high unbalanced potential (voltage difference) of the electrodes, the CorrTran MV is drawing more power from the loop than available.	One way to deal with this problem is to set the loop current to a fixed value (max is 20 mA). This should only occur under very rare circumstances, where the corrosion rate is very small (loop current is approx. 4 mA) but at the same time there is a huge potential difference between the electrodes. This can indicate contamination of one or more electrodes, corrosion masking effects of buildup, or that one electrode is bent or missing from the probe.
Harmonics out of range	The HDA did not provide any valid results.	In some rare occasions the HDA calculation might not give a plausible result. Switch to LPR only mode if this flag persists to stay on. See section 3.3.4 for more information.
Internal failure	Hardware failure detected	Replace transmitter
ADC failure	ADC failure detected	Replace transmitter
Memory failure	Memory failure detected	Replace transmitter

Table 5. Device Status Codes Troubleshooting Guide (continued from previous page)

9 MEASURING PRINCIPLE

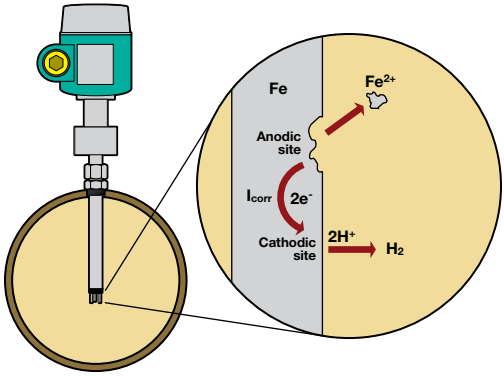


Figure 44. CorrTran MV Corrosion Cell

General corrosion

Linear Polarization Resistance (LPR) is based on the fact that in a corroding electrode the relationship between i_{corr} and the polarization resistance is give by the following equation:

$i_{corr} = \frac{B}{R_p}$, where $R_p = \frac{\Delta E}{\Delta I}$ with ΔE being the applied voltage and ΔI the resulting current.

Harmonic Distortion Analysis (HDA) allows CorrTran MV to determine i_{corr} without using the Tafel slopes (ba, bc). This is typically done by applying a low frequency sinusoidal voltage and determining the distance of the resulting current.

CorrTran MV accurately measures the general corrosion rate by implementing Harmonic Distortion Analysis (HDA) to improve the performance of Linear Polarization Resistance (LPR). A process-specific Stern-Geary voltage (Bharm) is calculated with every measurement cycle through HDA. This value is then implemented in the LPR corrosion rate calculation resulting in a highly accurate self adjusting, process specific corrosion rate calculation. CorrTran MV can measure the general corrosion rate from 0 … 1000 mpy (0 … 25 mmpy).

Localized Corrosion (Pitting)

Electrochemical Noise (ECN) is the method of monitoring spontaneous fluctuations generated at the interface of the corroding metal and process solution. As localized corrosion occurs, these fluctuations increase.

The CorrTran MV monitors for these fluctuations on the electrode surfaces for 17 minutes. It then performs a statistical analysis resulting in a unitless pitting factor value between 0 and 1. A pitting factor of nearly 0 represents no localized corrosion activity and a pitting factor of 1 represents high localized corrosion activity. Independent studies have revealed that a sustained pitting factor of greater than 0.3 is cause for concern and you should investigate the source of the elevated Localized Corrosion rate. For more information on the interpretation of localized corrosion please review our white paper: “Detecting and Interpreting Localized Corrosion Using CorrTran MV.”

Conductance

Solution resistance is a measure of how easily electricity flows along a certain path through an electrical element. The reciprocal of the solution resistance is solution conductance.

The CorrTran MV measures solution resistance in order to more accurately calculate the general corrosion rates. As an added feature CorrTran MV provides you with the solution conductance in units of Siemens as the tertiary variable that is not scalable. CorrTran MV requires a minimum solution conductance of 4 µS in order to provide reliable corrosion data.

The solution conductance value that CorrTran MV provides can be used to approximate solution conductivity by this relationship:

$$Conductivity\left(\frac{S}{cm}\right) \approx \frac{Conductance\ (S)}{19}$$

Solution conductivity is a function of distance. As the electrodes corrode, their sizes and geometry change causing this correlation to deteriorate. The CorrTran MV should not be considered as a replacement for standard conductivity meters.

10 APPENDIX A

CorrTran electrode materials

Electrode Material	K-Value	UNS Number	Model Number
Aluminum			
1100	10940.96	A91100	CME-0N
2024	11400.51	A92024	CME-0O
7075		A97075	CME-1O
Carbon Steel & Alloys			
1010	11486.66	G10100	CME-0S
1018	11597.63	G10180	CME-0A
1020	11401.49	G10200	CME-1T
C4130	11283.76	G41300	CME-1R
A53 Grade B	11583.07	K03005	CME-0B
ASTM A105	11298.74	K03504	CME-0R
A36	11368.92	K02600	CME-0V
A285 Grade C	11359.95	K02801	CME-1Q
Pipe Steel & API			
A106 Grade B	11342.61	K03006	CME-0U
API 5L Grade B	11441.28	–	CME-0W
API 52X-65	11440.94	–	CME-1C
API 5L X52 (STE 360.7)	11443.31	–	CME-1F
API 5L X60	11444.40	–	CME-1H
API 5L Grd A	11443.89	–	CME-1L
API 5L X42	11429.12	–	CME-1N
Stainless Steel			
304	11334.57	S30400	CME-0C
304L	11342.80	S30403	CME-0D
316	11513.39	S31600	CME-0E
316L	11519.53	S31603	CME-0F
316 Ti	11382.15	S31635	CME-1M
317L	11400.62	S31703	CME-1G
904L	11287.19	N08904	CME-1K
254SMO	11306.19	–	CME-1S-K4079
Copper Alloys			
CDA715 (Cu/Ni 70/30)	11337.86	C71500	CME-0I
CDA110ETP (99.9 Cu)	11686.71	C11000	CME-0J
CDA706 (Cu/Ni 90/10)	11513.44	C70600	CME-0K
CDA687 (aluminum brass)	12411.53	C68700	CME-0L
CDA443 (ARS AD.Brass)	12324.74	C44300	CME-0M
CDA220 Bronze		C22000	CME-1P
Super Alloys			
Hastelloy C-276	11666.48	N10276	CME-0Q
Zinc Alloys			
Zinc		Z15001	CME-0Z

Table 6. Electrode Material Guide

Probe mounting guide

Key #	Probe Style*	Process Connection	Transmitter Mounting	Electrode Style	O-ring Material
A	Fixed	NPT, flange	Direct	Standard finger	Viton
B	Fixed	NPT, flange	Remote	Standard finger	Viton
C	Adjustable	NPT	Direct	Standard finger	Viton
D	Adjustable	NPT	Remote	Standard finger	Viton
E	Retractable	NPT	Remote	Standard finger	Viton
F	Special design**	—	—	—	—
G	Fixed	NPT, flange	Direct	Standard finger	Kalrez
H	Fixed	NPT, flange	Remote	Standard finger	Kalrez
I	Adjustable	NPT	Direct	Standard finger	Kalrez
J	Adjustable	NPT	Remote	Standard finger	Kalrez
K	Retractable	NPT	Remote	Standard finger	Kalrez
L	Fixed	NPT, flange	Direct	Flush	N/A
M	Fixed	NPT, flange	Remote	Flush	N/A
N	Adjustable	NPT	Direct	Flush	N/A
O	Adjustable	NPT	Remote	Flush	N/A
P	Retractable	NPT	Remote	Flush	N/A
Q	Retractable	Flange	Remote	Flush	N/A
R	Retractable	Flange w/ bleed valve	Remote	Flush	N/A
S	Retractable	Flange	Remote	Standard finger	Viton
T	Retractable	Flange w/ bleed valve	Remote	Standard finger	Viton
U	Retractable special design**		—	—	—
V	Retrievable	UNS	Remote	Standard finger	Viton
W	Retrievable	UNS	Remote	Flush	N/A

* Fixed - Fixed insertion length
Adjustable - Adjustable insertion length
Retractable - Adjustable insertion length, can be removed under pressure
Retrievable - Adjustable insertion length, can be removed
Other designs available upon request.

** Consult factory

Table 7. Probe Mounting Guide

Default settings

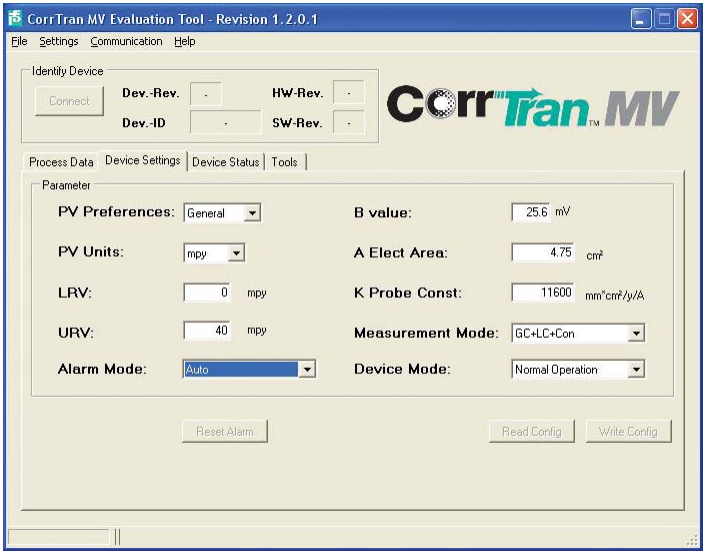
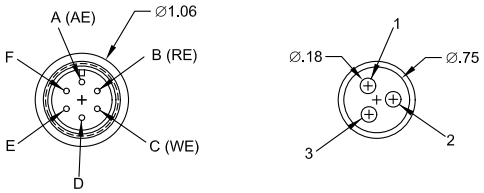


Figure 45. CorrTran MV default settings



PROBE WIRING	
CONNECTOR	ELECTRODE
A	1
B,D	2
C	3

Figure 46. CorrTran pinout diagram

11 APPENDIX B: CorrTran EC Startup

Insert the batteries as shown in the photo below:

Figure 47. Note battery orientation for proper polarity

Press the reset button and hold it down until the LED flashes GREEN.

CorrTran EC is now running.

11.1 CorrTran MV/EC Evaluation Tool

CorrTran EC is not supported by PACTware. Please disregard those sections in the manual. The programming tool for CorrTran EC is the Evaluation Tool package which you will find on the CD accompanying the unit.

11.1.1 Main Menu-Monitoring EC

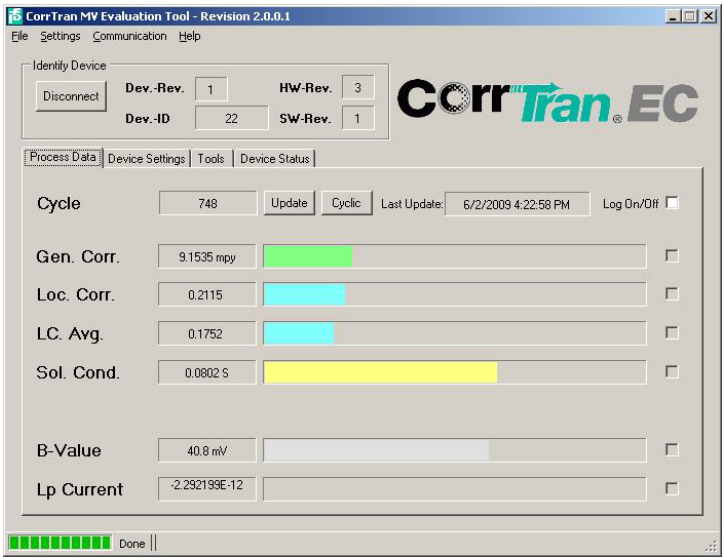


Figure 48. Main menu

You can choose to monitor CorrTran EC from this screen. This is not advisable in the long run as you will need to keep your PC in proximity to the unit. You also keep the CorrTran EC constantly "awake" which substantially shortens the battery life. It is more advisable to log

data internally to the CorrTran EC and then retrieve this data on a memory stick.

11.1.2 Device Settings Tab

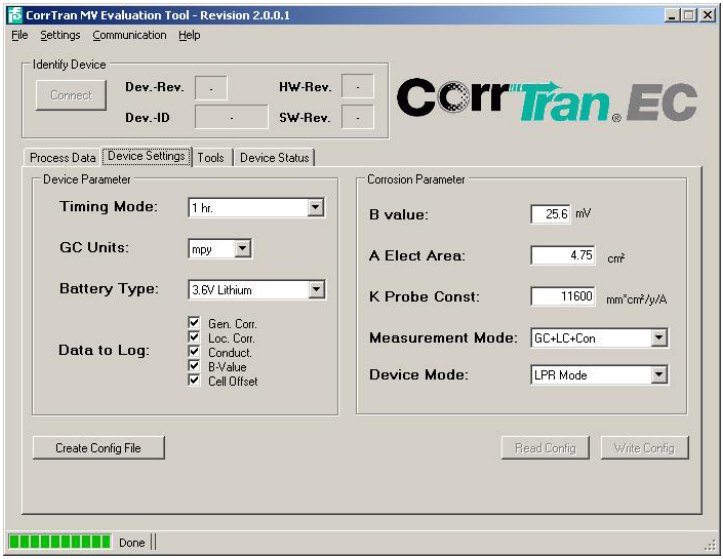


Figure 49. Device settings tab

From the Device Settings Menu you can make the initial settings on the CorrTran EC and save them to the nonvolatile memory in the unit.

Timing Mode: Sets the data logging interval of CorrTran EC.

GC Units: General corrosion units. Choices are mils/year (mpy) or millimeters/year (mmpy).

Battery Type: Choose the battery type to match the ones you are using. For the Demo using the SAFT batteries choose 3.6 V Lithium.

Data to Log: Choose what you want logged internally to CorrTran EC.

On the Corrosion Parameter panel, you may enter your own Stearn-Geary value for B value.

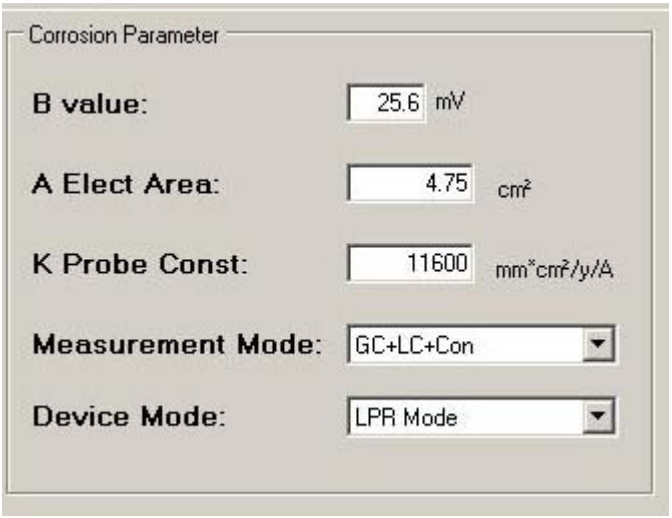


Figure 50. Corrosion parameter panel

A Elect Area: This parameter is the electrode area, it should remain 4.75 cm^2 for standard finger electrodes and XXX cm^2 for flush electrodes. For whatever reason, should you change the electrode area, this parameter should be updated to maintain the accuracy of the calculation.

K Probe Constant: You can update this value if you are using LPR Mode only. If you are using Normal Mode, the K constant will update automatically after the first measurement.

Measurement Mode: Selects which parameters are measured and therefore affect the speed in which the unit operates.

11.1.3 Retrieving Data From CorrTran EC

To retrieve data from CorrTran EC you must have a USB solid-state memory stick with at least 512 KB of available storage space.

Install the memory stick in the CorrTran EC. The green light will flash indicating a data transfer in progress.

11.2 Hints on Extending Battery Life

By comparison to CorrTran itself, the memory stick is a huge consumer of battery power and life. Your demo unit is shipped with very high-density, 3.6 V, Li-SOCl2 batteries. These batteries will operate CorrTran for months under typical use and allow retrieval of data on several occasions. Replacements are available. However, there may be a time when it is no longer possible to retrieve data from the unit. During this time, CorrTran will still log data. There is just insufficient battery capacity to retrieve the data from the memory. For this reason, we recommend that you take a spare set of batteries to the unit when you retrieve the data or connect the unit to auxiliary power.