

## Model CET5000 Series SmartCET<sup>®</sup> Corrosion Monitoring Transmitter – multivariable output version

CET5000-M Multivariable

## Specification and Model Selection Guide

### Description

The SmartCET<sup>®</sup> multivariable transmitter will detect general corrosion and localized corrosion (pitting) in real-time connecting to a distributed control system or process knowledge system via a 4-20mA signal and compatible HART<sup>®</sup> protocol.

The CET5000M model provides four outputs, which include general corrosion rate, an indicator for localized corrosion (Pitting Factor), Stern-Geary constant (B-value), and fourth variable to help diagnose the corrosion mechanism. The transmitter connects to the process environment through a process specific probe and electrode combination.

### Function

The SmartCET instrument utilizes state-of-the-art algorithms and data analysis techniques to accurately measure corrosion rate and pitting.

SmartCET executes on a 7-minute measurement cycle and performs an automated standard linear polarization resistance (LPR) technique along with an electrochemical noise (ECN) measurement. These techniques provide the corrosion rate and an indication of localized (pitting) corrosion.

To further enhance accuracy of the general corrosion rate, Harmonic Distortion Analysis is applied to calculate a B value based upon the actual process conditions, which is made available as one of the outputs. The default B value can be changed in the transmitter based upon the calculated value.

SmartCET connects to a variety of probe and electrode configurations. Some configurations are insertion probe with three finger electrodes, insertion probe with flush-mounting electrodes, flange mounted insertion probe with electrodes, and flange mounted flow-thru ring electrodes.

### Features

- On-line, Real-Time Corrosion Monitoring
- Two-wire 4-20mA Transmitter HART<sup>®</sup>
- Multivariable Output with general corrosion rate, localized corrosion indicator (pitting), dynamic B-value, and an additional variable for corrosion mechanism analysis
- Withstands 1500 psi (102 bar) Process Pressure (consult factory for high pressure applications)
- Standard 3/4" NPT Process Connection for Insertion Probe Type
- Custom Configuration

**Transmitter Housing**  
Model:  
CET5000-M

**Optional Extended cable For Remote Mounting**



(6 or 12 feet length)

**Probe**  
(See probe mounting guide on following pages)

**Electrode**  
(See electrode materials guide on following pages)

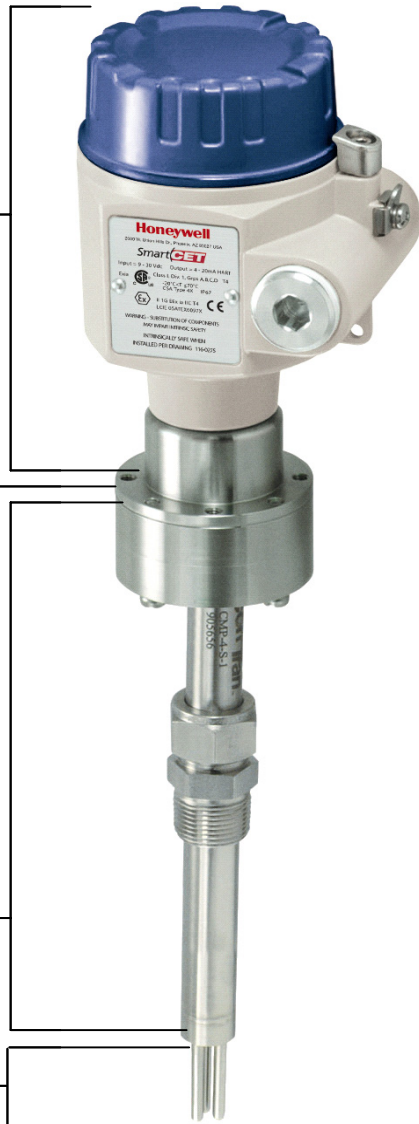


Figure 1 Corrosion Monitoring Transmitter

## SPECIFICATIONS

General Specifications	
<b>Output signal</b>	4-20mA signal (two-wire) with HART
<b>Supply voltage</b>	9-30 Vdc
<b>Rated Operating Voltage</b>	9 VDC minimum at max loop current 2-wire (4-20mA)
<b>Max load with 24VDC power supply</b>	680 ohms with high alarm capability 750 ohms without high alarm
<b>Linearity</b>	0.0015% non linear
<b>Resolution</b>	17 bit
<b>B value (default)</b>	25.6mV
Operating and Storage Conditions	
<b>Operating Temperature</b>	-40°F to +158°F (-40°C to +70°C)
<b>Storage Temperature</b>	-40°F to +185°F (-40°C to +85°C)
Process Conditions	
<b>Process Temperature (Max.)</b> 316 Stainless Steel Probe <i>Direct Mount:</i> <i>Remote Mount:</i> Glass Epoxy Probe	Custom probes with higher ratings available  250°F (121°C) 500°F (260°C) peak, 400°F average  150°F (65°C)
<b>Process Pressure (Max.)</b>	3600 psi (245 bar) 316 stainless steel, retrievable probe double sealed  1500 psi (102 bar) 316 stainless steel, retractable probe double sealed  100 psi (7 bar) glass epoxy probe
<b>O-Ring (set of 3)</b>	Viton (Viton® is registered trademarks of DuPont Dow Elastomers)
Physical Specifications	
<b>Protection</b>	NEMA 4x (applies to transmitter directly mounted with probe)
<b>Enclosure Material</b>	Aluminum
<b>Process connection</b>	¾"NPT (for insertion probes)
<b>Electrical connection</b>	¾"NPT
<b>Wiring Terminal</b>	Accept up to 1.5mm - 14AWG
<b>Mounting</b>	Probe mounts direct on process pipe, transmitter can be direct or remote mounted to probe.
<b>Weight</b>	1.1 lb (500g)
Certifications and Approvals	
<b>Electrical Classifications</b>	<ul style="list-style-type: none"> <li>• CSA (Canada and US) Class 1 Div 2, Groups A, B, C, D</li> <li>• CSA Intrinsic Safety Class I, II, III; Div 1 Groups A, B, C, D, E, F, G</li> <li>• CE Mark</li> <li>• ATEX – Ex II 1G EEx ia IIC T4, -40C &lt;Ta &lt; 70C</li> </ul>

**Model Selection Guide**

Model Selection Guide  
34-SC-16-01 Issue 1

**SmartCET corrosion transmitter for Real-time, online corrosion measurement - corrosion is the new process variable**

The SmartCET multivariable transmitter will detect general corrosion and localized corrosion (pitting) in real-time connecting to a distributed control system or process knowledge system. The CET5000M model provides four outputs, which include general corrosion rate, an indicator for localized corrosion (Pitting Factor), Stern-Geary constant (B value), and fourth variable to help diagnose the corrosion mechanism. The transmitter connects to the process environment through a process specific probe and electrode combination.

Features include:

- 4-20mA signal and compatible HART protocol
- New corrosion measurements available approximately every seven minutes
- Flexible sensor configuration and design allows for process specific probe and electrode application.

This MSG produces a valid model number for ordering the transmitter. Probes and/or electrodes are ordered separately.



**SmartCET CET5000**

**Instructions**

- Select the desired key number. The arrow to the right marks the selection available.
- Make the desired selections from Tables I through VI using the column below the proper arrow. A dot ( • ) denotes availability.

Key Number    I    II    III    IV    V    VI

\_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

**KEY NUMBER - SmartCET CET5000 Corrosion Transmitter**

Description
SmartCET single variable for General Corrosion
SmartCET single variable for Localized Corrosion (Pitting Factor)
SmartCET Multivariable Output

Selection	Availability		
CET5000G	↓		
CET5000P		↓	
CET5000M			↓

**TABLE I - Process Connection**

Process Connection	
3/4" NPT, 316L	
3/4" NPT Nylon Adjustable Fitting	
1" - 150 lb Flange	
1" - 300 lb Flange	
1 1/2" - 150 lb Flange	
1 1/2" - 300 lb Flange	
2" 150 lb Flange	
2" 300 lb Flange	
Ring electrode	
No selection	

N21	•	•	•
NP3	•	•	•
A31	•	•	•
A32	•	•	•
A51	•	•	•
A52	•	•	•
A61	•	•	•
A62	•	•	•
000	•	•	•
XXX	•	•	•

**TABLE II - Probe Material / Mounting / Length**

Measurement / Probe Material	
Inches 316 L	
Inches Epoxy Glass	
Millimeters 316L	
Millimeter Epoxy Glass	
Ring Electrode	
No selection	

CB _ _ _ _	a	a	a
CF _ _ _ _	b	b	b
DB _ _ _ _	a	a	a
DF _ _ _ _	b	b	b
NA _ _ _ _	c	c	c
XX _ _ _ _	•	•	•

Table II continued next page

TABLE II - Probe Material / Mounting / Length (continued)

		Availability				
		Selection	G	P	M	
Probe Mounting and Style	Standard Insertion, Direct Mount, Fixed, SS, Viton	--- A ---	d	d	d	
	Standard Insertion, Remote Mount, Fixed, SS, Viton	--- B ---	d	d	d	
	Standard Insertion, Direct Mount, Adjustable, SS, Viton	--- C ---	d	d	d	
	Standard Insertion, Remote Mount, Adjustable, SS, Viton	--- D ---	d	d	d	
	Retractable Insertion, Remote Mount, Adjustable, SS, Viton	--- E ---	d	d	d	
	Special (Consult Factory)	--- F ---	•	•	•	
	Standard Insertion, Direct Mount, Fixed, SS, Kalrez	--- G ---	d	d	d	
	Standard Insertion, Remote Mount, Fixed, SS, Kalrez	--- H ---	d	d	d	
	Standard Insertion, Direct Mount, Adjustable, SS, Kalrez	--- I ---	d	d	d	
	Standard Insertion, Remote Mount, Adjustable, SS, Kalrez	--- J ---	d	d	d	
	Retractable Insertion, Remote Mount, Adjustable, SS, Kalrez	--- K ---	d	d	d	
	Flush Probe, Direct Mount, Fixed, SS, Triangle disks geometry	--- L ---	d	d	d	
	Flush Probe, Remote Mount, Fixed, SS, Triangle disks geometry	--- M ---	d	d	d	
	Flush Probe, Direct Mount, Adjustable, SS, Triangle disks geometry	--- N ---	d	d	d	
	Flush Probe, Remote Mount, Adjustable, SS, Triangle disks geometry	--- O ---	d	d	d	
	Retractable Flush, Remote Mount, Adjustable, SS, Triangle disks geometry	--- P ---	d	d	d	
	Flush Probe, Direct Mount, Fixed, SS, Interleaved	--- Q ---	d	d	d	
	Flush Probe, Remote Mount, Fixed, SS, Interleaved	--- R ---	d	d	d	
	Flush Probe, Direct Mount, Adjustable, SS, Interleaved	--- S ---	d	d	d	
	Flush Probe, Remote Mount, Adjustable, SS, Interleaved	--- T ---	d	d	d	
	Retractable Flush, Remote Mount, Adjustable, SS, Interleaved	--- U ---	d	d	d	
	High pressure insertion, Remote, Fixed, SS	--- V ---	d	d	d	
	High pressure flush, Remote, Fixed, SS, Triangle disks geometry	--- W ---	d	d	d	
	High pressure flush, Remote, Fixed, SS, Interleaved	--- X ---	d	d	d	
	Ring electrode, Remote Mount, Virgin PTFE gasket. (Specify electrode, flange, class and finish)	--- Y ---	e	e	e	
	Ring electrode, Remote Mount, Garlock Gylon gasket. (Specify electrode, flange, class and finish)	--- Z ---	e	e	e	
	Ring electrode, Remote Mount, other gasket material. (Specify electrode, size and pressure rating)	--- 1 ---	e	e	e	
	No selection	--- 2 ---	•	•	•	
	Probe Length	8 inch for 316L or epoxy glass, NPT Process Connection	--- 080	f	f	f
		12 inch for 316L, NPT or Flange Process Connection	--- 120	g	g	g
		18 inch for 316L, NPT or Flange Process Connection	--- 180	g	g	g
		24 inch for 316L, NPT or Flange Process Connection	--- 240	g	g	g
		200 mm for 316L or epoxy glass, NPT Process Connection	--- 200	g	g	g
		300 mm for 316L, NPT or Flange Process Connection	--- 300	g	g	g
450 mm for 316L, NPT or Flange Process Connection		--- 450	g	g	g	
610 mm for 316L, NPT or Flange Process Connection		--- 610	g	g	g	
Ring Electrode		--- RRR	c	c	c	
No selection		--- XXX	•	•	•	

**TABLE III - Electrode Material Guide**

	Electrode Material	Selection	Availability		
			G	P	M
	1018 Carbon Steel	0A	•	•	•
	A53 Grade B Carbon Steel	0B	•	•	•
	AISI 304 (Check with factory)	0C	•	•	•
	AISI 304L	0D	•	•	•
	AISI 316 (Check with factory)	0E	•	•	•
	AISI 316L	0F	•	•	•
	Carpenter 20 Cb3	0G	•	•	•
	Monel 400	0H	•	•	•
	CDA715 70-30 Cu-Ni	0I	•	•	•
	CDA 110ETP 99.9 Cu	0J	•	•	•
	CDA 706 90-10 Cu-Ni	0K	•	•	•
	CDA687 (Al Brass) (Check with factory)	0L	•	•	•
	CDA443( ARS AD. Brass)	0M	•	•	•
	Aluminum 1100	0N	•	•	•
	Aluminum 2024	0O	•	•	•
	Titanium GR2	0P	•	•	•
	Hastelloy C-276	0Q	•	•	•
	ASTM A105 Carbon Steel	0R	•	•	•
	AISI 1010 Carbon Steel	0S	•	•	•
	AL6061 Aluminum	0T	•	•	•
	A106 GrB	0U	•	•	•
	A36	0V	•	•	•
	5LGrB	0W	•	•	•
	C2000	0X	•	•	•
	C22	0Y	•	•	•
	Ductile Iron Grade 65-45-12	0Z	•	•	•
	A182 F5, 5Cr 1/2Mo	1A	•	•	•
	A182 F9, 9Cr 1Mo	1B	•	•	•
	API5LX-65 Carbon maganese pipeline steel	1C	•	•	•
	Duplex 2205	1D	•	•	•
	A516 Gr70	1E	•	•	•
	API 5LX52 (STE 360.7)	1F	•	•	•
	317L stainless steel	1G	•	•	•

**TABLE IV - Transmitter**

Housing	Aluminum housing with 3/4" electrical	A2	•	•	•
Electrical Output	Electronic Output - 4-20mA with HART	IH	•	•	•
Transmitter Mount	Direct Mount (not for ring electrodes)	1	h	h	h
	Remote 6 feet cable	2	i	i	i
	Remote 12 feet cable	3	i	i	i
	Special (Consult Factory)	4	•	•	•

**TABLE V - Approvals**

Approvals	General Purpose	GP	•	•	•
	CSA, NI, Class 1, Div 2, Group A-D	D2	•	•	•
	CSA, IS, Class 1, Div 1, Group A-D; ATEX, FM	IS	•	•	•

TABLE VI - Insertion Length for Insertion Probes or Ring Flange Size+Class+Finish		Availability			
		Selection	G	P	M
Insertion length - inches	5.0 inches	050	j	j	j
	5.2 inches	052	j	j	j
	5.4 inches	054	j	j	j
	5.6 inches	056	j	j	j
	5.8 inches	058	j	j	j
	6.0 inches	060	j	j	j
	6.2 inches	062	j	j	j
	6.4 inches	064	j	j	j
	6.6 inches	066	j	j	j
	6.8 inches	068	j	j	j
	7.0 inches	070	j	j	j
	7.2 inches	072	j	j	j
	7.4 inches	074	j	j	j
	7.6 inches	076	j	j	j
	7.8 inches	078	j	j	j
	8.0 inches	080	j	j	j
	8.2 inches	082	j	j	j
	8.4 inches	084	j	j	j
	8.6 inches	086	j	j	j
	8.8 inches	088	j	j	j
	9.0 inches	090	j	j	j
	9.2 inches	092	j	j	j
	9.4 inches	094	j	j	j
	9.6 inches	096	j	j	j
	9.8 inches	098	j	j	j
	10.0 inches	100	j	j	j
	10.2 inches	102	j	j	j
	10.4 inches	104	j	j	j
	10.6 inches	106	j	j	j
	10.8 inches	108	j	j	j
	11.0 inches	110	j	j	j
	11.2 inches	112	j	j	j
	11.4 inches	114	j	j	j
	11.6 inches	116	j	j	j
	11.8 inches	118	j	j	j
	12.0 inches	120	j	j	j
	12.2 inches	122	j	j	j
	12.4 inches	124	j	j	j
	12.6 inches	126	j	j	j
	12.8 inches	128	j	j	j
	13.0 inches or mm	130	k	k	k
	13.2 inches	132	j	j	j
	13.4 inches	134	j	j	j
	13.6 inches	136	j	j	j
	13.8 inches	138	j	j	j
	14.0 inches or mm	140	k	k	k
	14.2 inches	142	j	j	j
	14.4 inches	144	j	j	j
	14.6 inches	146	j	j	j
	14.8 inches	148	j	j	j
15.0 inches or mm	150	k	k	k	
15.2 inches	152	j	j	j	
15.4 inches	154	j	j	j	
15.6 inches	156	j	j	j	
15.8 inches	158	j	j	j	
16.0 inches or mm	160	k	k	k	
16.2 inches	162	j	j	j	
16.4 inches	164	j	j	j	
16.6 inches	166	j	j	j	
16.8 inches	168	j	j	j	

Table VI continued next page

**TABLE VI - Insertion Length for Insertion Probes or Ring Flange Size+Class+Finish**

Insertion length - inches	Selection	Availability		
		G	P	M
17.0 inches or mm	170	k	k	k
17.2 inches	172	j	j	j
17.4 inches	174	j	j	j
17.6 inches	176	j	j	j
17.8 inches	178	j	j	j
18.0 inches or mm	180	k	k	k
18.2 inches	182	j	j	j
18.4 inches	184	j	j	j
18.6 inches	186	j	j	j
18.8 inches	188	j	j	j
19.0 inches or mm	190	k	k	k
19.2 inches	192	j	j	j
19.4 inches	194	j	j	j
19.6 inches	196	j	j	j
19.8 inches	198	j	j	j
20.0 inches or mm	200	k	k	k
20.2 inches	202	j	j	j
20.4 inches	204	j	j	j
20.6 inches	206	j	j	j
20.8 inches	208	j	j	j
21.0 inches or mm	210	k	k	k
21.2 inches	212	j	j	j
21.4 inches	214	j	j	j
21.6 inches	216	j	j	j
21.8 inches	218	j	j	j
22.0 inches or mm	220	k	k	k
22.2 inches	222	j	j	j
22.4 inches	224	j	j	j
22.6 inches	226	j	j	j
22.8 inches	228	j	j	j
23.0 inches or mm	230	k	k	k
23.2 inches	232	j	j	j
23.4 inches	234	j	j	j
23.6 inches	236	j	j	j
23.8 inches	238	j	j	j
24.0 inches or mm	240	k	k	k
24.2 inches	242	j	j	j
24.4 inches	244	j	j	j
24.6 inches	246	j	j	j
24.8 inches	248	j	j	j
25.0 inches or mm	250	k	k	k
25.2 inches	252	j	j	j
25.4 inches	254	j	j	j
25.6 inches	256	j	j	j
25.8 inches	258	j	j	j
26.0 inches or mm	260	k	k	k
26.2 inches	262	j	j	j
26.4 inches	264	j	j	j
26.6 inches	266	j	j	j
26.8 inches	268	j	j	j
27.0 inches or mm	270	k	k	k
27.2 inches	272	j	j	j
27.4 inches	274	j	j	j
27.6 inches	276	j	j	j
27.8 inches	278	j	j	j
28.0 inches or mm	280	k	k	k

Table VI continued next page

**TABLE VI - Insertion Length for Insertion Probes or Ring Flange Size+Class+Finish**

Insertion length - millimeters	Selection	Availability		
		G	P	M
135 mm	135	m	m	m
145 mm	145	m	m	m
155 mm	155	m	m	m
165 mm	165	m	m	m
175 mm	175	m	m	m
185 mm	185	m	m	m
195 mm	195	m	m	m
205 mm	205	m	m	m
215 mm	215	m	m	m
225 mm	225	m	m	m
235 mm	235	m	m	m
245 mm	245	m	m	m
255 mm	255	m	m	m
265 mm	265	m	m	m
275 mm	275	m	m	m
285 mm	285	m	m	m
290 mm	290	m	m	m
295 mm	295	m	m	m
300 mm	300	m	m	m
305 mm	305	m	m	m
310 mm	310	m	m	m
315 mm	315	m	m	m
320 mm	320	m	m	m
325 mm	325	m	m	m
330 mm	33	m	m	m
335 mm	335	m	m	m
340 mm	340	m	m	m
345 mm	345	m	m	m
350 mm	350	m	m	m
355 mm	355	m	m	m
360 mm	360	m	m	m
365 mm	365	m	m	m
370 mm	370	m	m	m
375 mm	375	m	m	m
380 mm	380	m	m	m
385 mm	385	m	m	m
390 mm	390	m	m	m
395 mm	395	m	m	m
400 mm	400	m	m	m
405 mm	405	m	m	m
410 mm	410	m	m	m
415 mm	415	m	m	m
420 mm	420	m	m	m
425 mm	425	m	m	m
430 mm	430	m	m	m
435 mm	435	m	m	m
440 mm	440	m	m	m
445 mm	445	m	m	m
450 mm	450	m	m	m
455 mm	455	m	m	m
460 mm	460	m	m	m
465 mm	465	m	m	m
470 mm	470	m	m	m
475 mm	475	m	m	m
480 mm	480	m	m	m
485 mm	485	m	m	m
490 mm	490	m	m	m
495 mm	495	m	m	m

Table VI continued next page

**TABLE VI - Insertion Length for Insertion Probes or Ring Flange Size+Class+Finish**

Insertion length - millimeters	Selection	Availability		
		G	P	M
500 mm	500	m	m	m
505 mm	505	m	m	m
510 mm	510	m	m	m
515 mm	515	m	m	m
520 mm	520	m	m	m
525 mm	525	m	m	m
530 mm	530	m	m	m
535 mm	535	m	m	m
540 mm	540	m	m	m
545 mm	545	m	m	m
550 mm	550	m	m	m
555 mm	555	m	m	m
600 mm	600	m	m	m
605 mm	605	m	m	m
610 mm	610	m	m	m
615 mm	615	m	m	m
620 mm	620	m	m	m
625 mm	625	m	m	m
630 mm	630	m	m	m
635 mm	635	m	m	m
640 mm	640	m	m	m
645 mm	645	m	m	m
650 mm	650	m	m	m
655 mm	655	m	m	m
660 mm	660	m	m	m
665 mm	665	m	m	m
670 mm	670	m	m	m
675 mm	675	m	m	m
680 mm	680	m	m	m
685 mm	685	m	m	m
690 mm	690	m	m	m
695 mm	695	m	m	m
700 mm	700	m	m	m
705 mm	705	m	m	m
710 mm	710	m	m	m
No Selection	No selection	XXX	•	•

**RESTRICTIONS**

Restriction Letters	Available Only With		Not Available With	
	Table	Selection	Table	Selection
a			I	NP3 000
b			I	N21 A31, A32 A51, A52 A61, A62 000
c			I	N21 NP3 A31, A32 A51, A52 A61, A62

**RESTRICTIONS**

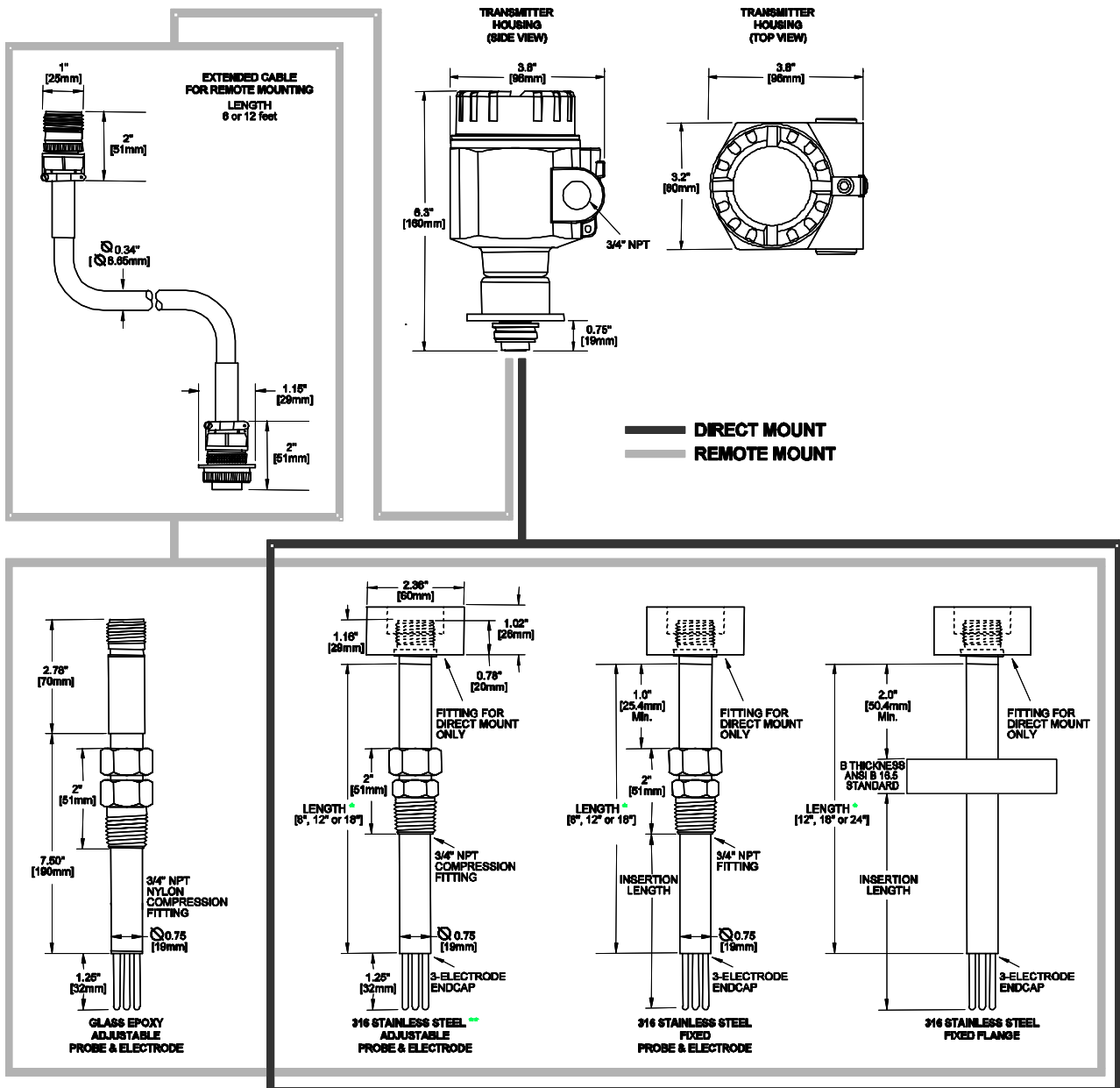
Restriction Letters	Available Only With		Not Available With	
	Table	Selection	Table	Selection
d			II	CF _ _ _ _ DF _ _ _ _ NA _ _ _ _
e			I  II  II	N21 NP3 A31, A32 A51, A52 A61, A62 CB _ _ _ _ CF _ _ _ _ DB _ _ _ _ DF _ _ _ _
f			I  II	A31, A32 A51, A52 A61, A62 000 NA _ _ _ _
g			I II	000 CF _ _ _ _ DF _ _ _ _ NA _ _ _ _
h			I II	000 NA _ _ _ _
i			II	_ _ A _ _ _ _ _ C _ _ _ _ _ G _ _ _ _ _ I _ _ _ _ _ L _ _ _ _ _ N _ _ _ _ _ Q _ _ _ _ _ S _ _ _
j			I II	NP3 000 CF _ _ _ _ DB _ _ _ _ DF _ _ _ _ NA _ _ _ _
k			I II	NP3 000 CF _ _ _ _ DF _ _ _ _ NA _ _ _ _
m			I II	NP3 000 CB _ _ _ _ CF _ _ _ _ DF _ _ _ _ NA _ _ _ _

# CET5000 Supplemental SmartCET Corrosion Transmitter Accessories & Kits

Description	Part Number	List Price
Galvanic Isolator – 1 Channel	50022364-001	**
Galvanic Isolator – 2 Channel	50022364-002	**
Remote Probe Cable – 6 Ft	50022365-001	**
Remote Probe Cable – 12 Ft	50022365-002	**
Hart USB Modem	50022366-001	**
Hart Interface Module –no relays	50022367-001	**
Hart Interface Module –two relays	50022367-002	**

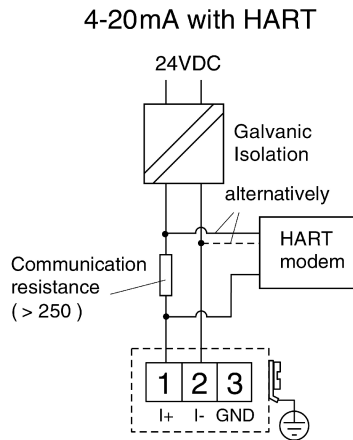
\*\* Consult Honeywell Order Entry Systems for current parts pricing.

## Housing Dimensions



## Configuration

### 2-wire connection with HART (DC)



Corrosion reading: update time 7.2 min (fixed)  
 The adjustments and scaling can be done using a hand held HART® calibrator. The tables below contain scaling information.

#### General Corrosion

Maximum Range: 250 mils/yr (6.35mm/yr)  
 with electrode area approx 1cm<sup>2</sup>. Consult factory for applications in higher corrosion environments.

#### Localized Corrosion (Pitting Factor)

Default Range:	0.001 – 1.0
Low Pitting:	0.001 – 0.01
Average Pitting:	0.01 – 0.1
High Pitting:	0.1 – 1.0

#### B-Value

Expected Range:	0.005 to 0.06 volts
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#### Corrosion Mechanism Indicator

Expected Range:	-2 to +2 $\mu\text{A}/\text{cm}^2$ .
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Values are dependent on material and environment.



Tlf: 67150 250 Faks: 67 150 251

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