

Data Sheet

DS-VA-MT3810-eng

March, 2008

Brooks® Model MT 3810

Metal Tube Variable Area Flowmeter with Optional Electronics based on Smart Meter Manager™ Technology

GENERAL FEATURES

- Broad range of flow capacities
- 5% Full scale accuracy
- Versatile construction for all gas and liquid applications
- No back pressure required for operation
- Flanged or female NPT connections
- Optional 4-20 mA and HART® programmable microprocessor transmitter with or without alarms and pulse output for totalization
- Electronics designed with either intrinsically safe or explosion proof construction to meet UL (US & Canada) ATEX certifications and CE requirements

DESCRIPTION

The Brooks® Model MT 3810 Variable Area Flowmeter is a rugged, all metal flowmeter offering 5% full scale accuracy. The MT 3810 is constructed with stainless steel components for measuring a variety of liquid and gas applications.

Flow rate indication is provided by means of magnetic coupling where a magnet, encapsulated in the float, is coupled to a rotatable magnet located in the rear of the indicator, thus turning the dial indicator mounted on the meter.

Optional accessories available include 4-20 mA output with HART microprocessor transmitter with or without configurable alarms and pulse output for totalization. The microprocessor electronics are based on the proprietary Smart Meter Manager technology utilized as the basis for an array of Brooks products. Also available are front adjustable inductive alarms.

SPECIFICATIONS - METER

Capacities, Pressure Drop and Viscosity Immunity
Ceilings
Refer to Table 1

Accuracy
Standard Flow Accuracy: $\pm 5\%$ Full Scale

Repeatability
0.25% Full Scale



Model MT 3810

Pressure Ratings

Refer to Table 2 for maximum non-shock pressure

Pressure Equipment Directive (PED) 97/23/EC

Flow meter complies under Sound Engineering Practices (SEP) or Categories I, II or III.
Refer to Table 1

Scales

Standard: Detachable aluminum plate single or dual scales

Graduations: Choice of direct reading units, millimeter or percentage of maximum flow

Operating Fluid Temperature Limits/Meter only

Minimum: -58°F (-50°C)

Maximum: 420°F (215°C)

Meter with valve: 392°F (200°C)

Refer to Table 3 for temperature limitations for meters with electronics.

Brooks® Model MT 3810

MATERIALS OF CONSTRUCTION:

Metering Tube
316L stainless steel

Flanges and End Fittings
316/316L dual certified stainless steel

Connections
150 lbs or 300 lbs RF ANSI B 16.5 flanges or PN 40
DIN 2527/2635 or Female NPT
125/175 Ra flange finish
Vertical inlet and outlet

Floats
Standard: 316L stainless steel

O-rings (NPT only)
Standard: Viton® fluoroelastomers
Optional: Teflon®

Indicator Housing and Cover
Enclosure NEMA 4X construction
Die cast aluminum, polyurethane paint with glass window

Meter Dimensions

Refer to Figure 1, Sizes 7-13

Ordering Information and Model Code

Refer to Table 4

OPTIONAL ACCESSORIES

Needle Valves and Sight Flow Indicators
For flowrate control, needle valves may be externally piped into the inlet or outlet side of the instrument. Needle valves can be supplied up to size 10 (1") maximum 6.6 gpm (1,500 l/hr) water equivalent. Sight flow indicators are available for all flanged meters and to size 13 (2") NPT meters.

OPTIONAL ELECTRONIC EQUIPMENT

Electronic equipment available with the Model MT 3810 includes the Microprocessor Transmitter, Microprocessor Transmitter/Alarm/Pulse Output for totalization, Inductive Alarms, and Transmitter with Inductive Alarms, refer to pages 5 through 16 for additional information. All models are designed to be either Intrinsically Safe or Explosion Proof.

Table 1 Model MT 3810 Capacities, Pressure Drop and Viscosity Immunity Ceiling

METER SIZE	CONNECTION SIZE		FLOAT CODE	FLOAT MATERIAL STAINLESS STEEL 316L								PED Category
	DIN	ANSI		WATER		AIR ^{1,2}		Press Drop	Press Drop	VIC (cSt)	Max. Visc	
	DN mm	inches		l/h	gpm	scfm	nm ³ /h	mbar	inches WC	(cSt)	(cSt)	
7	15	1/2"	A	25	0.11	0.49	0.78	30	13	1	40	SEP
			B*	65	0.28	1.2	2	30	13	1	20	SEP
			C	130	0.59	2.4	3.7	30	13	1	120	SEP
			D*	200	0.88	3.7	5.8	35	15	1	20	SEP
8	15	1/2"	A	250	1.1	5.2	8.2	45	19	2	250	SEP
			B	400	1.7	7.7	12	55	23	1	180	SEP
			C	650	2.8	11	18	60	25	2	475	SEP
			D	1000	4.4	21	33	130	53	1.5	250	SEP
10	25	1"	A	1200	5.2	19	30	60	25	5	475	CAT I, II or III
			B	1500	6.6	31	49	70	29	1.5	400	CAT I, II or III
			C	2400	10	41	65	85	35	7	475	CAT I, II or III
			D	3500	15	65	100	155	63	4	475	CAT I, II or III
12	40	1 1/2"	A	4000	17	67	100	50	21	50	475	CAT I, II or III
			B	6000	26	94	140	60	25	30	475	CAT I, II or III
			C	8000	35	150	230	150	61	2	475	CAT I, II or III
			D	10000	46	210	330	300	121	2	475	CAT I, II or III
13	50	2"	A	6500	28	100	160	50	21	50	475	CAT I, II or III
			B	9500	41	160	250	60	25	50	475	CAT I, II or III
			C	12000	55	200	310	100	41	2.5	475	CAT I, II or III
			D	20000	88	390	620	300	121	1	475	CAT I, II or III

1. Air flows in scfm are given at 70°F and 14.7 psia 2. Air flows in nm³/h are given at 0°C and 1.013 bar (a)
3. *Minimum operating pressure required 7 psig / 0.48 bar

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Table 2 Model MT 3810 Pressure Ratings

Flange Rating*	316/316L Stainless Steel (psig at indicated temperature)						
	-20°F to 100°F	200°F	300°F	400°F	500°F	600°F	617°F
150 lb.	275	240	215	195	170	140	134
300 lb.	720	620	560	515	480	450	448

Threaded NPT	316L Stainless Steel (psig at indicated temperature)						
	-20°F to 100°F	200°F	300°F	400°F	500°F	600°F	617°F
7 & 8	1500	1500	1400	1400	1300	1200	1200
10	1500	1500	1400	1400	1300	1200	1200
12	1500	1500	1400	1400	1300	1200	1200
13	1300	1300	1200	1200	1100	1000	1000

*Flanges are dual certified 316/316L Stainless Steel

Table 3 Maximum Fluid Temperature at 104°F (40°C) Ambient

Size	Indicator Only	Indicator with Alarm	Indicator with Transmitter
7 thru 13	-58° thru 420° F	-22° thru 320° F	-22° thru 195° F
	-50° thru 215° C	-30° thru 160° C	-30° thru 90° C

3810 Minimum and Maximum Ambient Temperature

Indicator Only	Indicator with Alarm or Transmitter
-22° thru 150° F	-22° thru 150° F
-30° thru 65° C	-30° thru 65° C

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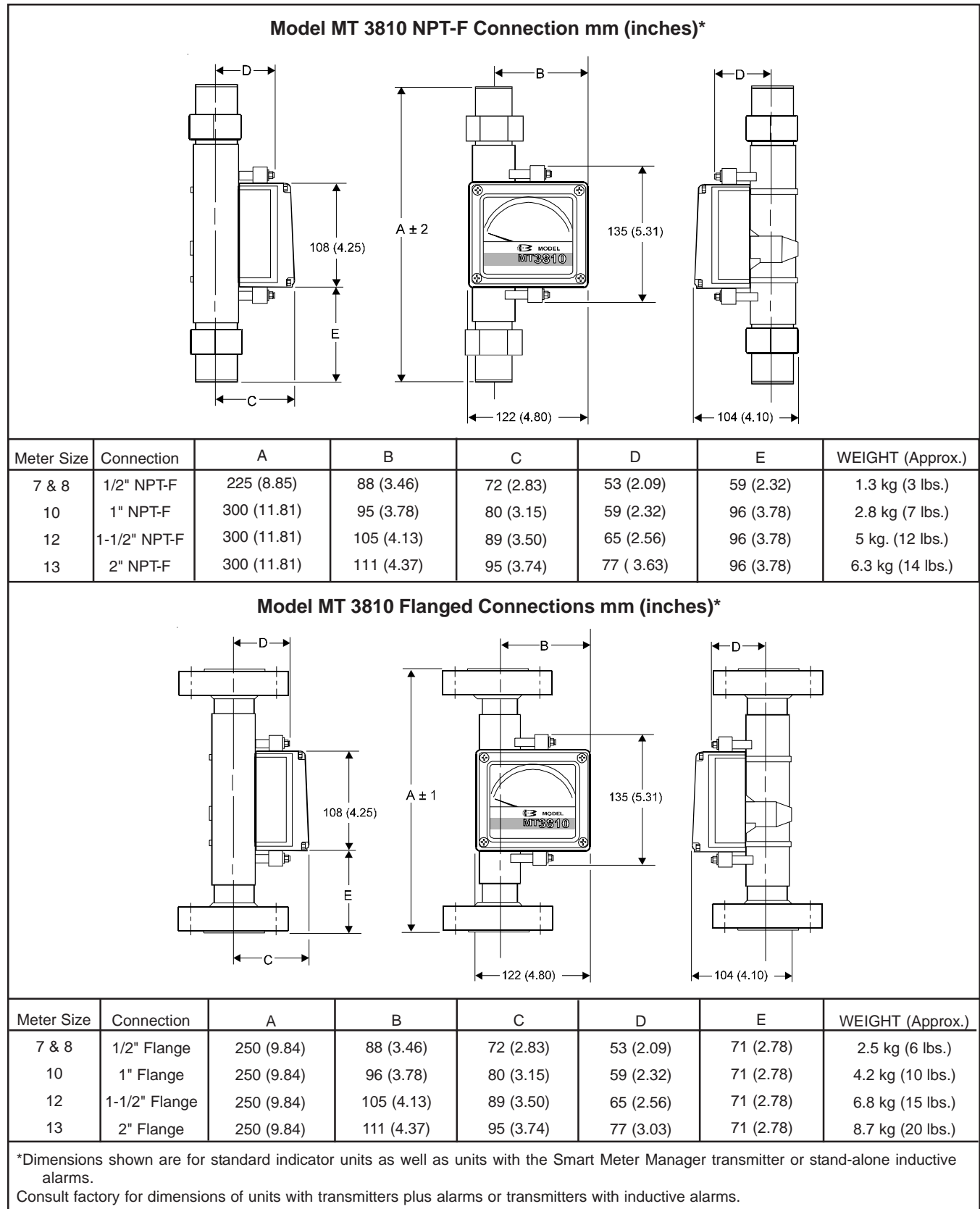


Figure 1 Model MT 3810 Meter Dimensions

Optional Electronic Equipment

Microprocessor Transmitter With or Without Alarms and Pulse Output Based on Brooks Smart Meter Manager Technology

Design Features

- A 2-wire, loop-powered device for ease of wiring and installation
- 4-20 mA analog output for flowrate, with Bell-202 modulated HART communication channel
- User selectable 0% and 100% analog output ranges with optional smoothing
- Flexible (mix & match) units of measure for flowrates, totals, temperatures, densities, etc.
- Two flow totalizers: Resettable and inventory totalization
- User configurable, scaleable pulse output for various engineering units
- Comprehensive alarms for both process flow and internal diagnostic checks
- Easily configured and compatible with other plant equipment
- Patented magnetic sensor which is resistant to external magnetic fields

Description

“Smart Inside” best defines the Brooks transmitter with optional alarms and pulse output for totalization. The transmitter (with or without the alarms and pulse output) is a compact microprocessor device designed to interface directly with the Model MT 3810 flowmeter. The microprocessor electronics are based on the Brooks Smart Meter Manager (SMM™) technology common to other Brooks flowmeters.

The transmitter is HART-programmable for numerous variables such as flow rate, totalization, calibration factors, and high-low alarm parameters. It is programmable with easy-to-use hand held configurators such as the Fisher-Rosemount™ HART 275 Communicator. Prior to shipment, commonly used default values are programmed by Brooks to ensure ease of operation and quick startup. However, parameters may be reprogrammed by the user if needed. The 2-wire electronics system is easy to install and inface with other existing equipment such as process management systems or maintenance control packages.

In operation the microprocessor transmitter converts the measured process flow into a 4-20 mA output with HART protocol. The signal originates when the float magnet inside the metering tube passes a magnetic sensor mounted on the transmitter. Flow rate information may

be viewed locally at the meter scale or displayed remotely (along with other flow data) as a function of external support systems through analog/pulse outputs or multiple digital communications.

In addition to transmitter features, this unit can also be ordered with optional alarms and pulse output provided by open collector switches. One or two alarms may be programmed prior to shipment of the unit or at the customer site with a hand-held communicator.

Specifications - SMM Microprocessor Transmitter with or without Alarm and Pulse Output

EMC Directive 89/336/EEC: EN 50081, EN 50082 and EN 61326-1

Hazardous Location Classification

Enclosure: Type 4X/ IP65
Ambient Temperature: $-22^{\circ}\text{F} \geq T_{\text{amb}} \leq 150^{\circ}\text{F}$ ($-30^{\circ}\text{C} \geq T_{\text{amb}} \leq 65^{\circ}\text{C}$)

Intrinsically Safe

United States and Canada UL Listed, E73889, Vol. 1, Sect. 15
Class I, II and III, Division 1, Groups A, B, C, D, E, F, and G; T4

Europe – KEMA 01ATEX1235 X



II 2 G EEx ia IIC T4
II 2 D T135°C

Entity Parameters (Transmitter):

$U_i = V_{\text{max}} = 30 \text{ Vdc}$; $I_i = I_{\text{max}} = 140 \text{ mA}$; $C_i = 15 \text{ nF}$; $L_i = 0 \text{ mH}$

Entity Parameters (Integral Alarms):

$U_i = V_{\text{max}} = 30 \text{ Vdc}$; $I_i = I_{\text{max}} = 45 \text{ mA}$; $C_i = 0 \text{ nF}$; $L_i = 0 \text{ mH}$

Non-Incendive

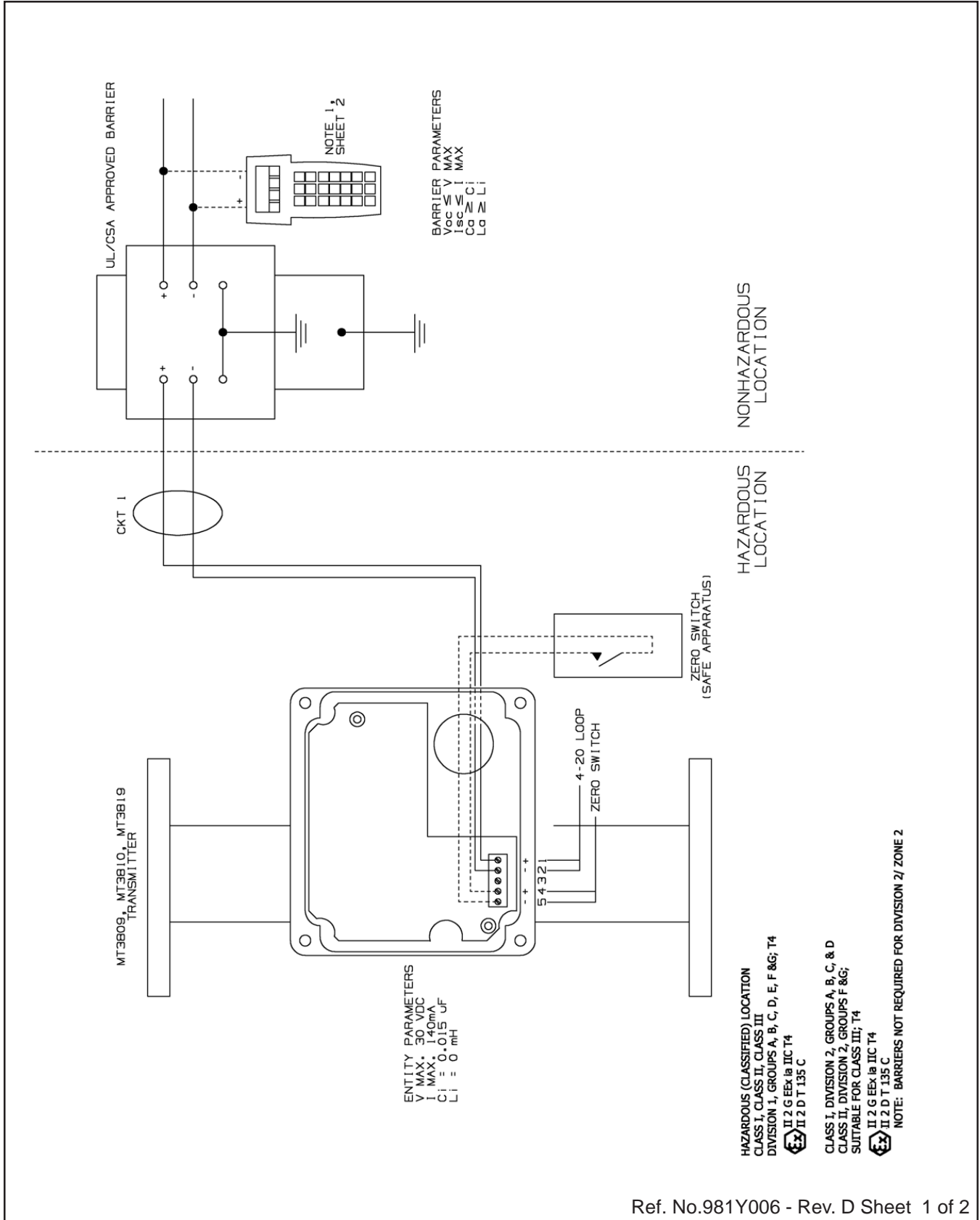
United States and Canada UL Listed, E73889, Vol. 1, Sect. 15
Class I, II, III, Division 2, Groups A, B, C, D, F, and G; T4

Europe – KEMA 01ATEX1236



II 3 G EEx nA II T4
II 3 D T135°C

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Figure 2 Transmitter Only Wiring Diagram

- NOTES:
 1- THIS DEVICE IS A ROSEMOUNT MODEL 275 HAND HELD COMMUNICATOR.
 2- THE LENGTH OF THE CABLES WILL BE RESTRICTED TO THE FOLLOWING VALUES:

CIRCUIT	GROUP	C (uF)	L (mH)	CABLE LENGTH
CKT1	A,B	0.14uF	2.9mH	2.333 FT MAX
CKT1	C,E	0.39uF	11.6mH	6.500 FT MAX
CKT1	D,F,G	1.04uF	23.6mH	17.333 FT MAX

FOR INTRINSIC SAFETY PURPOSES, THE MAXIMUM CABLE LENGTH WAS CALCULATED USING A CAPACITANCE OF 60 pF/FT AND AN INDUCTANCE OF 0.20uH/FT PER UL913.

- 3- WARNING SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
 4- AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.
 DC UNLESS IT HAS BEEN DETERMINED THAT THE VOLTAGE HAS BEEN ADEQUATELY ISOLATED FROM THE BARRIERS.
5. REFER TO INSTRUMENT SOCIETY OF AMERICA (ISA) RECOMMENDED PRACTICE RP12.6 FOR INSTALLING INTRINSICALLY SAFE LOOPS AND THE NATIONAL ELECTRICAL CODE, NFPA 70, ARTICLE 504, FOR CANADA, INSTALLATIONS MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1.

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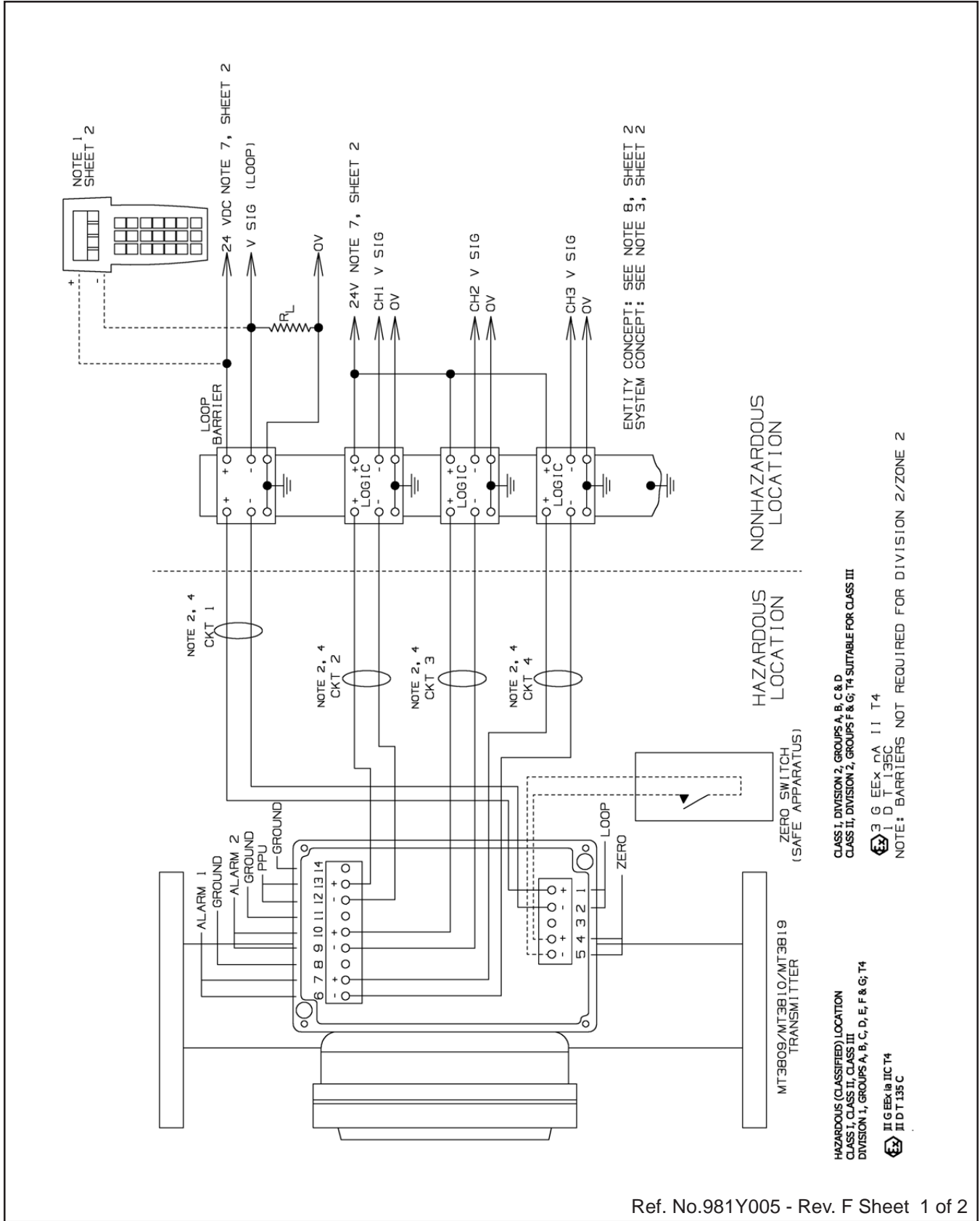


Figure 4 Transmitter with Alarm and Pulse Outputs Wiring Diagram

- NOTES:
 1- THIS DEVICE IS A ROSEMOUNT MODEL 275 HAND HELD COMMUNICATOR.
 2- CKT1, CKT2, CKT3, CKT4 MUST RUN IN SEPARATE CABLES OR IN ONE CABLE WHICH HAS SUITABLE INSULATION. REFER TO INSTRUMENT SOCIETY OF AMERICA (ISA) RECOMMENDED PRACTICE RP12.6 FOR INSTALLING INTRINSICALLY SAFE LOOPS AND THE NATIONAL ELECTRICAL CODE, NFPA 70, ARTICLE 504. FOR CANADA, INSTALLATIONS MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1. WHERE APPLICABLE, CKT1, CKT2, CKT3, AND CKT4 MUST BE IN COMPLIANCE WITH EN50039 CLAUSE 5.3.2; TYPE B CABLE
 3- LOOP BARRIER: R. STAHL INC. PART NO. 9160/13-11-11
 LOGIC BARRIER: R. STAHL INC. PART NO. 9002/77-280-094-00
 4- THE LENGTH OF THE CABLES WILL BE RESTRICTED TO THE FOLLOWING VALUES:

CIRCUIT	GROUP	C (uF)	L (mH)	CABLE LENGTH
CKT1	A,B	0.14uF	4.4mH	2,333 FT MAX
CKT1	C,E	0.43uF	17.2mH	7,167 FT MAX
CKT1	D,F,G	1.1uF	35.7mH	18,333 FT MAX
CKT2,3,4	A,B	0.14uF	18.5mH	2,333 FT MAX
CKT2,3,4	C,E	0.41uF	67mH	6,833 FT MAX
CKT2,3,4	D,F,G	1.1uF	155mH	18,333 FT MAX

- FOR INTRINSIC SAFETY PURPOSES, THE MAXIMUM CABLE LENGTH WAS CALCULATED USING A CAPACITANCE OF 60 pF/FT AND AN INDUCTANCE OF 0.20uH/FT PER UL913.
 5- WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
 6- THE BARRIERS MUST NOT BE CONNECTED TO ANY DEVICE WHICH USES OR GENERATES IN EXCESS OF 250 VOLTS RMS OR DC UNLESS IT HAS BEEN DETERMINED THAT THE VOLTAGE HAS BEEN ADEQUATELY ISOLATED FROM THE BARRIERS.
 7- LOOP SUPPLY VOLTAGE: 24 VDC ±10%, LOGIC SUPPLY VOLTAGE: 24 VDC ±10%.

8- CERTIFIED ASSOCIATED APPARATUS WITH APPLICABLE DIVISION AND GROUP OR ZONE AND GROUP APPROVAL WITH ENTITY PARAMETERS:

DIVISIONS	ZONES	Transmitter Parameters	Alarm and Pulse Parameters
$V_{oc} \leq V_{max}$	$U_o \leq U_i$	$V_{max} = U_i = 30$	$V_{max} = U_i = 30$
$I_{sc} \leq I_{max}$	$I_o \leq I_i$	$I_{max} = I_i = 140mA$	$I_{max} = I_i = 45$
$C_a \geq C_i + C_{cable}$	$C_o \geq C_i + C_{cable}$	$C_i = 0.015 uF$	$C_i = 0$
$L_a \geq L_i + L_{cable}$	$L_o \geq L_i + L_{cable}$	$L_i = 0$	$L_i = 0$

The Entity Concept allows interconnection of intrinsically safe and associated apparatus not specifically examined in combination as a system, when the approved values of V_{oc} (or U_o) and I_{sc} (or I_o) for the associated apparatus are less than or equal to V_{max} (or U_i) and I_{max} (or I_i) for the intrinsically safe apparatus, and the values of C_a (or C_o) and L_a (or L_o) for the associated apparatus are greater than $C_i + C_{cable}$, $L_i + L_{cable}$.

Figure 5 Transmitter with Alarm and Pulse Outputs Wiring Notes

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Explosion-proof/ Flame-proof

United States and Canada UL Listed, E73889, Vol. 1, Sect. 14

Class I, Division 1, Groups C, D;

Dust Ignition-proof, Class II, Division 1, Groups E, F, G; Class III; T4

Europe – KEMA 01ATEX2207 X



II 2 G EEx d IIB T4
II 2 D T135° C

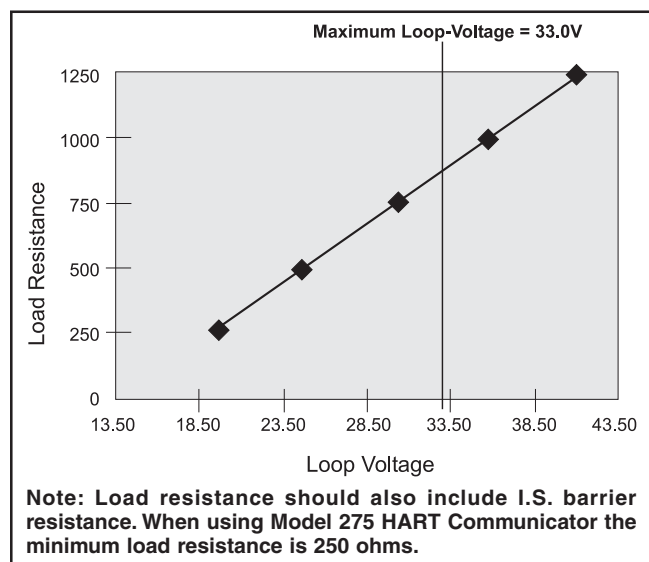


Figure 6 Power Supply vs. Maximum Load Resistance

Output Signals

Transmitter: 4-20 mA analog output with HART

Update Rate: 4 times per sec.

Range: 3.8 to 22.0 mA

Two Alarm Outputs (open collector)

Optically isolated outputs assignable to alarms, reverse flow indicator, or manual valve.

Maximum off-state voltage: 30 Vdc

Maximum off-state current: 0.05 mA

Maximum on-state voltage: 1.2 Vdc

Maximum on-state current: 20 mA

One Pulse Output (open collector)

Optically isolated. Scaleable to a variety of engineering unit systems (pulses per liter, gallons, etc.)

Range: 1 Hz to 1 kHz

Maximum off-state voltage: 30 Vdc

Maximum off-state current: 0.05 mA

Maximum on-state voltage: 1.2 Vdc

Maximum on-state current: 20 mA

Linearity

Less than 1% at I maximum

Temperature Influence

Less than 0.04% per °C

Voltage Influence

Less than 0.002%/Vdc

Load Resistance Influence

± 0.1% full scale

Transmitter, Alarm and Pulse Output Wiring Diagrams

Refer to Figures 2, 3, 4, 5 and 7

For Division 1 explosion proof installations, the optional explosion proof enclosure must be used. This enclosure does not use the auxiliary terminal box, as shown on some of the installation diagrams. All connections are made directly within the housing. Cable entry device shall be certified as Flame-proof type, suitable per the conditions of use and correctly installed. If used with conduit, refer to Figure 7, a sealing device shall be provided in accordance with Figure 7.

For Division 2 non-incendive installations, either the standard enclosure or the explosion proof enclosure may be used.

For both Division 1 explosion proof and Division 2 non-incendive installations, the barriers shown in the installation drawings are unnecessary. However, NEC Class 2 circuits are required.

The circuits shall be wired separately or using a Multicore Cable Type B, in accordance with EN 60079-14. Also wiring must be done in accordance with the applicable electrical codes, ie., NEC Chapter 5, CEC Section 18 and any local codes.

TRANSMITTER ACCESSORIES

General purpose and intrinsically safe HART compatible power supplies are available in 110V, 24V and 220V.

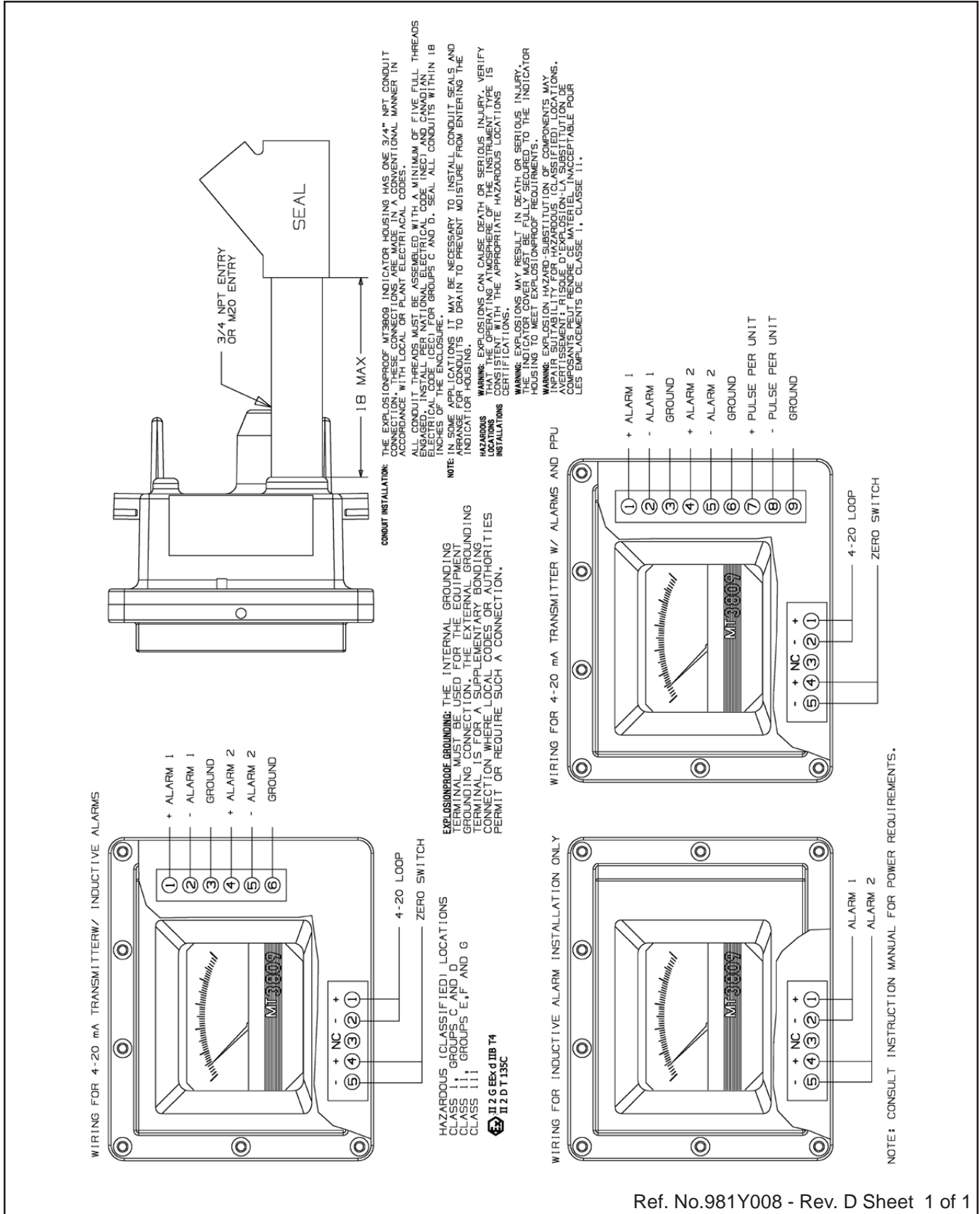
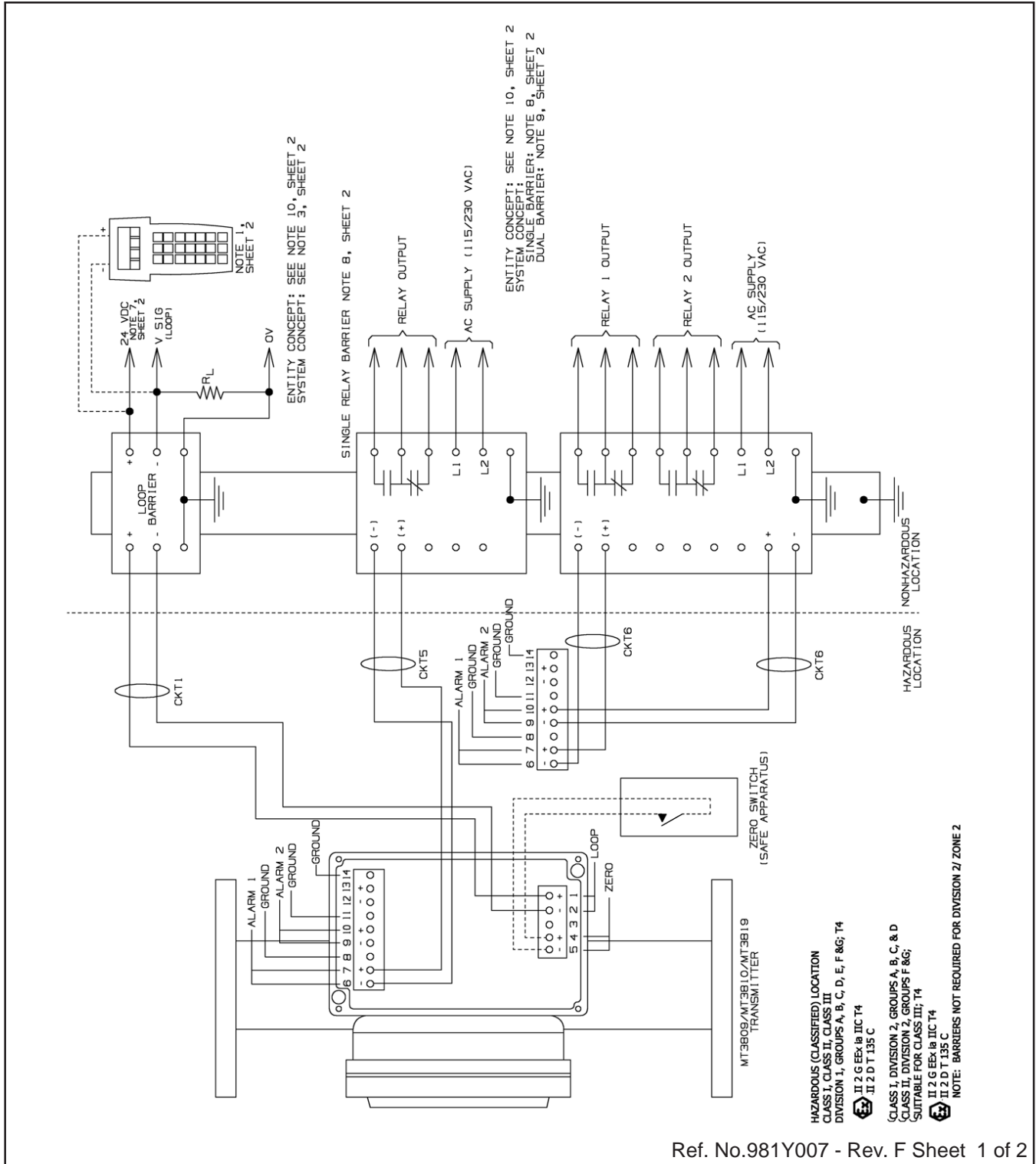


Figure 7 Model MT3810 Explosion-Proof Housing Wiring Diagram

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Optional Electronic Equipment
 Microprocessor Transmitter with Inductive Alarms

This combined system provides both the sophistication of the microprocessor along with the simplicity of one or two switch inductive alarms. Specifications for the transmitter are as stated previously and specifications for the front adjustable inductive alarms are as follows. For Wiring Diagrams, Refer to Figures 7, 8 and 9.



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Figure 8 Transmitter with Inductive Alarm Wiring Diagram

- NOTES:
 1- THIS DEVICE IS A ROSEMOUNT MODEL 275 HAND HELD COMMUNICATOR.
 2- CKT1, CKT5, AND CKT6 MUST RUN IN SEPARATE CABLES OR IN ONE CABLE WHICH HAS SUITABLE INSULATION. REFER TO INSTRUMENT SOCIETY OF AMERICA (ISA) RECOMMENDED PRACTICE RP12.6 FOR INSTALLING INTRINSICALLY SAFE LOOPS AND THE NATIONAL ELECTRICAL CODE, NFPA 70, ARTICLE 504. FOR CANADA, INSTALLATIONS MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1. WHERE APPLICABLE, CKT1, CKT5, AND CKT6 MUST BE IN COMPLIANCE WITH EN50039
 3- LOOP BARRIER: R. STAHL INC., PART NO. 9160/13-11-11

4- THE LENGTH OF THE CABLES WILL BE RESTRICTED TO THE FOLLOWING VALUES:

CIRCUIT	GROUP	C (uF)	L (mH)	CABLE LENGTH	BARRIER NO.
CKT1	A,B	0.14uF	4.4mH	2.333 FT MAX	9002/13-280-093-00
CKT1	C,E	0.43uF	17.2mH	7.167 FT MAX	9002/13-280-093-00
CKT1	D,F,G	1.1uF	35.7mH	18.333 FT MAX	9002/13-280-093-00
CKT5,6	A,B	1.27uF	8.48mH	2.167 FT MAX	KFD2-SR-EX2-W
CKT5,6	C,E	3.82uF	2.99mF	63.667 FT MAX	KFD2-SR-EX2-W
CKT5,6	D,F,G	1.02uF	7.44mF	169.667 FT MAX	KFD2-SR-EX2-W
CKT5,6	A,B	1.26uF	8.48mH	2.167 FT MAX	KFA5/KFAG-SR2-EX2-W
CKT5,6	C,E	3.82uF	2.99mF	63.667 FT MAX	KFA5/KFAG-SR2-EX2-W
CKT5,6	D,F,G	1.02uF	7.44mF	169.667 FT MAX	KFA5/KFAG-SR2-EX2-W
CKT5,6	A,B	6.00uF	3.40mH	10.000 FT MAX	WE77/EX1-2U
CKT5,6	C,E	2.50uF	1.30mF	41.667 FT MAX	WE77/EX1-2U
CKT5,6	D,F,G	7.50uF	3.00mF	125.000 FT MAX	WE77/EX1-2U

- FOR INTRINSIC SAFETY PURPOSES, THE MAXIMUM CABLE LENGTH WAS CALCULATED USING A CAPACITANCE OF 60 pF/FT AND AN INDUCTANCE OF 2.0mH PER 100 FT OF CABLE. THE MAXIMUM CABLE LENGTH WAS CALCULATED USING A CAPACITANCE OF 60 pF/FT AND AN INDUCTANCE OF 2.0mH PER 100 FT OF CABLE.
 5- WARNING SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
 6- THE BARRIERS MUST NOT BE CONNECTED TO ANY DEVICE WHICH USES OR GENERATES IN EXCESS OF 250 VOLTS RMS OR DC UNLESS IT HAS BEEN DETERMINED THAT THE VOLTAGE HAS BEEN ADEQUATELY ISOLATED FROM THE BARRIERS.
 7- LOOP SUPPLY VOLTAGE: 24 VDC ±10%, LOGIC SUPPLY VOLTAGE: 24 VDC ±10%.

- 8- SINGLE RELAY BARRIER: (WE77/EX1) 115 VAC, 45-60 HZ
 PEPPERL & FUCHS (WE77/EX1) 115 VAC, 45-60 HZ
 (KFAB-SR2-EX1-W 230 V, 45-65 HZ)
 (KFAB-SR2-EX1-W 230 V, 45-65 HZ)
 9- DUAL RELAY BARRIER: (WE77/EX2) 115 VAC, 45-60 HZ
 PEPPERL & FUCHS (WE77/EX2) 115 VAC, 45-60 HZ
 (WE77/EX2-2201-230 VAC, 45-60 HZ)
 (KFAS-SR2-EX2-W 115 VAC, 45-65 HZ)
 (KFAB-SR2-EX2-W 230 V, 45-65 HZ)
 DC POWERED BARRIER
 MTL 40160 20-35 VDC
 45.00 mA
 REED RELAY CONTACT RATINGS
 10 WATTS 0.5 A 35 VDC
 RESPONSE TIME 2MSEC MAX
 NOTE: REACTIVE LOADS MUST BE ADEQUATELY SUPPRESSED.

- PEPPERL & FUCHS
 KFD2-SR2-EX2-W
 POWER SUPPLY 20-30 VDC, 50 MA MAX
 Vcc=5V, Icc=8 MA
 SWITCH POINT/SWITCHING HYSTERESIS 1.2 MA-2.1 MA/±0.2 MA
 INPUT PULSE LENGTH/INPUT PULSE PAUSE ≥ 20 MSEC/≥ 20 MSEC
 OUTPUT: DC 450V/2A Cosφ=0.7
 RESPONSE TIME ≈ 20 MSEC

- 10- Certified associated apparatus with applicable division and group or zone and group approval with entity parameters:
 DIVISIONS ZONES
 Vcc ≤ Vmax Uo ≤ Ui
 Icc ≤ Imax Io ≤ Ii
 Ca ≥ Ci + Ccable Co ≥ Ci + Ccable
 La ≥ Li + Lcable Lo ≥ Li + Lcable
 Lcable = 0
 Ci = 0.015 uF
 Li = 0
 Imax = 11 mA
 Ii = 140 mA
 Uo = 30 V
 Ui = 16 V
 Cosφ = 0.7
 Ci = 50 nF
 Li = 250 uH

- Transmitter Parameters
 Vmax=Ui=16 V
 Imax=Ii=25 mA
 Ci=50nF
 Li=250 uH
 Alarm and Pulse Parameters
 The Entity Concept allows interconnection of intrinsically safe and associated apparatus not specifically examined in combination as a system, when the approved values of Vcc (or Uo) and Icc (or Io) for the associated apparatus are less than or equal to Vmax (or Ui) and Imax (or Ii) for the intrinsically safe apparatus, and the values of Ca (Co) and La (Lo) for the associated apparatus are greater than Ci + Ccable, Li + Lcable.

Figure 9 Transmitter with Inductive Alarm Wiring Notes

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Inductive Alarm Switches

Design Features

- 1 or 2 normally open inductive limit switches
- For low or high limit signaling/switching

Description

One or 2 electronic limit switches can be installed in the indicator housing to allow initiation of signaling or switching functions on a preset flow value. The limit switch operates as a slot initiator that is inductively actuated by a disc mounted on the pointer shaft. Any flow value can be used for setting the limit value by sliding the initiator along the indicator scale. Minimum setting distance between two limit switches is approximately 40% full scale. The position of the initiator also serves to visually indicate the set value. Settings can be adjusted by removing the indicator cover, loosening, moving and retightening of the alarm indication needle, and replacement of the indicator cover.

Specifications

EMC Directive 89/336/EEC: EN 50081, EN 50082 and EN 61326-1

Hazardous Location Classification

Enclosure: Type 4X/ IP65

Ambient Temperature: $-22^{\circ}\text{F} \geq T_{\text{amb}} \leq 150^{\circ}\text{F}$ ($-30^{\circ}\text{C} \geq T_{\text{amb}} \leq 65^{\circ}\text{C}$)

Intrinsically Safe

United States and Canada UL Listed, E73889, Vol. 1, Sect. 15
Class I, II and III, Division 1, Groups A, B, C, D, E, F, and G; T4

Europe – KEMA 01ATEX1235 X



II 2 G EEx ia IIC T4
II 2 D T135°C

Entity Parameters:

$U_i = V_{\text{max}} = 16 \text{ Vdc}$; $I_i = I_{\text{max}} = 25 \text{ mA}$; $C_i = 50 \text{ uF}$;
 $L_i = 250 \text{ uF}$

Non-Incendive

United States and Canada UL Listed, E73889, Vol. 1, Sect. 15
Class I, II, III, Division 2, Groups A, B, C, D, F, and G; T4

Europe – KEMA 01ATEX1236



II 3 G EEx nA II T4
II 3 D T135°C

Explosion-proof/ Flame-proof

United States and Canada UL Listed, E73889, Vol. 1, Sect. 14
Class I, Division 1, Groups C, D;
Dust Ignition-proof, Class II, Division 1, Groups E, F, G; Class III; T4

Europe – KEMA 01ATEX2207 X



II 2 G EEx d IIB T4
II 2 D T135°C

Power Supply

5-25 Vdc; 25 mA max.

Impedance

Approximately 1 kohm with cam absent
Approximately 8 kohm with cam present

Alarm Wiring Diagrams

Explosion-proof/ Flame-proof: Refer to Figure 7

Intrinsically Safe or Non Incendive: Refer to Figures 10 and 11.

For Division 1 explosion proof installations, the optional explosion proof enclosure must be used. This enclosure does not use the auxiliary terminal box, as shown on some of the installation diagrams. All connections are made directly within the housing. Cable entry device shall be certified as Flame-proof type, suitable per the conditions of use and correctly installed. If used with conduit, refer to Figure 7, a sealing device shall be provided in accordance with Figure 7.

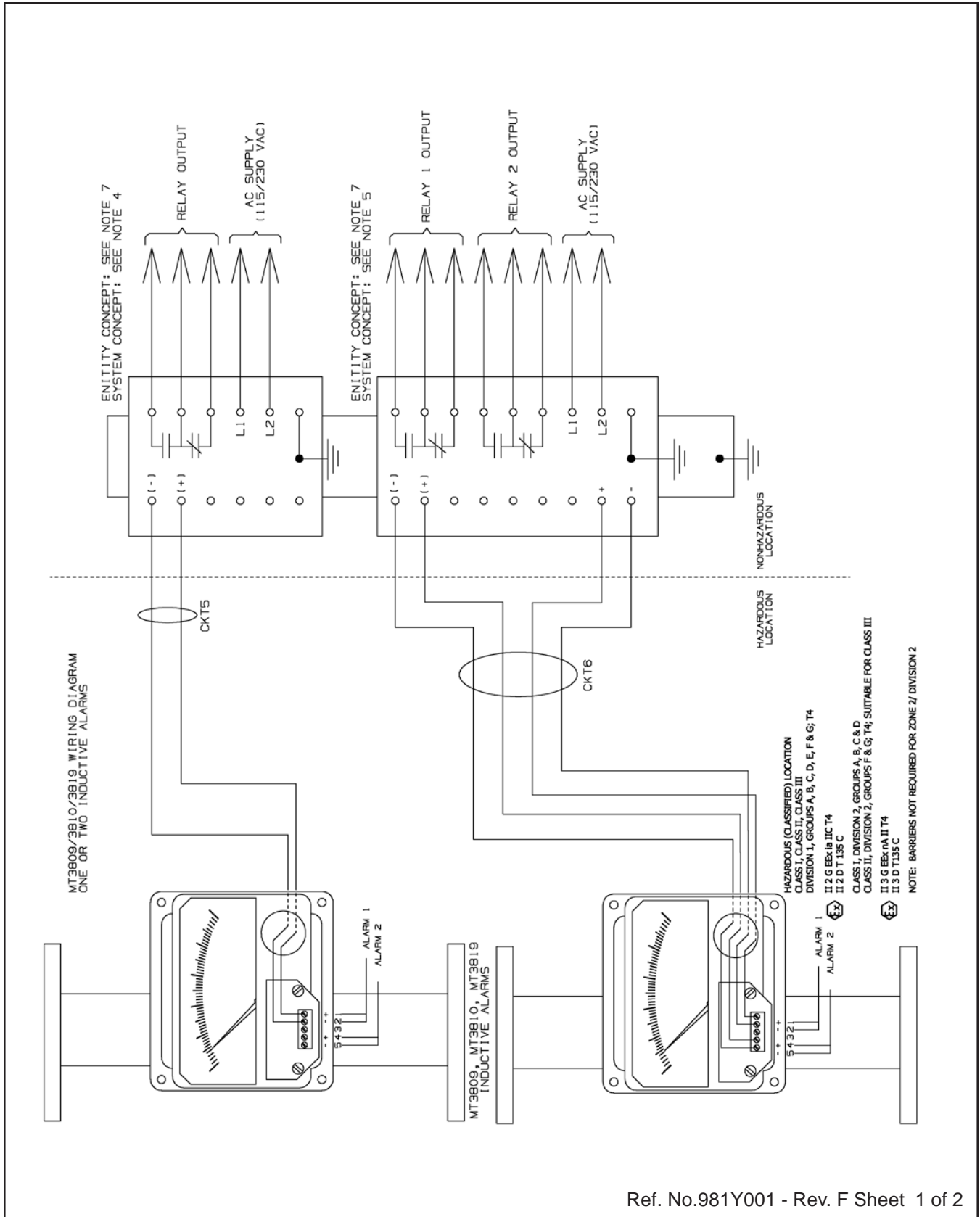
For Division 2 non-incendive installations, either the standard enclosure or the explosion proof enclosure may be used.

For both Division 1 explosion proof and Division 2 non-incendive installations, the barriers shown in the installation drawings are unnecessary. However, NEC Class 2 circuits are required.

The circuits shall be wired separately or using a Multicore Cable Type B, in accordance with EN 60079-14. Also wiring must be done in accordance with the applicable electrical codes, ie., NEC Chapter 5, CEC Section 18 and any local codes.

Alarm Accessories

Amplifier Power Supply (approved isolated barrier) 1 or 2 channel approved for intrinsically safe application, remotely mounted, 115 or 230 Vac power. Single pole with double throw (SPDT) relay standard. For other configurations, consult factory.



Ref. No.981Y001 - Rev. F Sheet 1 of 2

Figure 10 Inductive Alarms Only Wiring Diagram

Brooks® Model MT 3810

NOTES:
 1- CKT5 AND CKT6 MUST RUN IN SEPARATE CABLES OR IN ONE CABLE WHICH HAS SUITABLE INSULATION. REFER TO INSTRUMENT SOCIETY OF AMERICA (ISA) RECOMMENDED PRACTICE RP12.6 FOR INSTALLING INTRINSICALLY SAFE LOOPS AND THE NATIONAL ELECTRICAL CODE, NFPA 70, ARTICLE 504. FOR CANADA, INSTALLATIONS MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART I.

THE LENGTH OF THE CABLES WILL BE RESTRICTED TO THE FOLLOWING VALUES:

CIRCUIT	GROUP	C (UF)	L (MH)	CABLE LENGTH	BARRIER NO.
CK15.6	A1B	1.2UF	9.48MH	211.167 FT MAX	KFD2-SR2-EX2-W
CK15.6	C1E	3.82UF	63.1667 FT MAX	63.1667 FT MAX	KFD2-SR2-EX2-W
CK15.6	D1F	1.02UF	7.44MH	169.1667 FT MAX	KFD2-SR2-EX2-W
CK15.6	A1B	3.82UF	9.48MH	211.167 FT MAX	KFAS/KFAS-SR2-EX2-W
CK15.6	C1E	3.82UF	63.1667 FT MAX	63.1667 FT MAX	KFAS/KFAS-SR2-EX2-W
CK15.6	D1F	1.02UF	7.44MH	169.1667 FT MAX	KFAS/KFAS-SR2-EX2-W
CK15.6	A1B	6.00UF	3.40MH	10.000 FT MAX	WE77/EX1-2U
CK15.6	C1E	1.50UF	1.30MH	41.1667 FT MAX	WE77/EX1-2U
CK15.6	D1F	7.50UF	3.00MH	125.000 FT MAX	WE77/EX1-2U

FOR INTRINSIC SAFETY PURPOSES, THE MAXIMUM CABLE LENGTH WAS CALCULATED USING A CAPACITANCE OF 60 pF/FT AND AN INDUCTANCE OF 1.20UH/FT PER UL913.

- 2- WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
- AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.
- 3- THE BARRIERS MUST NOT BE CONNECTED TO ANY DEVICE WHICH USES OR GENERATES IN EXCESS OF 250 VOLTS RMS OR DC UNLESS IT HAS BEEN DETERMINED THAT THE VOLTAGE HAS BEEN ADEQUATELY ISOLATED FROM THE BARRIERS.

4- SINGLE RELAY BARRIER: (WE77/EX1) 115 VAC, 45-60 HZ
 PEPPERL & FUCHS (WE77/EX1-220) 230 VAC, 45-60 HZ
 (KFAS-SR2-EX1-W 115 VAC, 45-65 HZ)
 (KFAS-SR2-EX1-W 230 V, 45-65 HZ)

RELAY RATINGS (PEPPERL & FUCHS WE77/EX1)
 AC V MAX \leq 250 VAC
 I MAX \leq 4 AMP
 P MAX \leq 500 VA/Cos 0=0.7
 DC 110 VDC/0.2 AMP
 60 VDC/0.6 AMP
 24 VDC/4.0 AMP

5- DUAL RELAY BARRIER: (WE77/EX2) 115 VAC, 45-60 HZ
 PEPPERL & FUCHS (WE77/EX2-220) 230 VAC, 45-60 HZ
 (KFAS-SR2-EX2-W 115 VAC, 45-65 HZ)
 (KFAS-SR2-EX2-W 230 V, 45-65 HZ)

RELAY RATINGS (PEPPERL & FUCHS WE77/EX2)
 AC V MAX \leq 250 VAC
 I MAX \leq 4 AMP
 P MAX \leq 500 VA/Cos 0=0.7
 DC 110 VDC/0.2 AMP
 60 VDC/0.6 AMP
 24 VDC/4.0 AMP

DC POWERED BARRIER
 MTL 4016 20-35 VDC
 45-160 mA
 FEED RELAY CONTACT RATINGS
 10 WATTS 0.5 A 35 VDC
 RESPONSE TIME 2MSEC MAX
 NOTE: REACTIVE LOADS MUST BE ADEQUATELY SUPPRESSED.

PEPPERL & FUCHS
 KFD2-SR2-EX2-W
 POWER SUPPLY 20-30 VDC, 50 MA MAX
 Vcc=8V, Isc=B MA
 SWITCH POINT/SWITCHING HYSTERESIS 1.2 MA-2.1 MA/ \approx 0.2 MA
 INPUT PULSE LENGTH/INPUT PULSE PAUSE \approx 20 MSEC/ \approx 20 MSEC
 OUTPUT: AC 250V/2A/Cos0 \geq 0.7
 DC 40V/2A RESISTIVE
 RESPONSE TIME \approx 20 MSEC

- 6- WHERE APPLICABLE CKT5, CKT6, MUST BE IN COMPLIANCE WITH EN50039 CLAUSE 5.3.2 TYPE B CABLE.
- 7- CERTIFIED ASSOCIATED APPARATUS WITH APPLICABLE DIVISION AND GROUP OR ZONE AND GROUP APPROVAL WITH ENTITY PARAMETERS:

DIVISIONS	ZONES
Voc \leq Vmax	Lo \leq Ui
Isc \leq Imax	Lo \leq Li
Ca \geq Ci + Ccable	Co \geq Ci = Ccable
La \geq Li + Lcable	Lo \geq Li = Lcable

The Entity Concept allows interconnection of intrinsically safe and associated apparatus not specifically examined in combination as a system, when the approved values of Voc (or Uo) and Isc (or Io) for the associated apparatus are less than or equal to Vmax (or Ui) and Imax (or Ii) for the intrinsically safe apparatus, and the values of Ca (Co) and La (Lo) for the associated apparatus are greater than Ci + Ccable, Li + Lcable.

Figure 11 Inductive Alarms Only Wiring Notes

Table 4 Ordering Information and Model Code

MODEL	BASIC MODEL TYPE						
3810A	THRU-FLOW METER, THREADED & FLANGED CONNECTIONS						
	CODE	MATERIALS OF CONSTRUCTION (Body, Float and Fittings/Flanges)					
	1	316/316L SS					
	METER AND CONNECTION SIZE						
			STANDARD CONNECTION SIZE		METER LAY LENGTH		
	CODE	METER SIZE	FLANGED	NPT (F)	FLANGED	NPT (F)	
	1	7	1/2"	1/2"	250mm	225mm	
	2	8	1/2"	1/2"	250mm	225mm	
	3	10	1"	1"	250mm	300mm	
	4	12	1.5"	1.5"	250mm	300mm	
	5	13	2"	2"	250mm	300mm	
	MAXIMUM FLOW						
	NOTE: LIQUID FLOW BASED ON WATER Sp.Gr. 1.0, Visc 1.0 CP						
	AIR FLOWS FOR SCFM ARE @ 14.7 PSIA AND 70oF(21oC); NM3/H @ 14.7 PSIA AND 32oF(0oC)						
	CODE	SIZE 7	SIZE 8	SIZE 10	SIZE 12	SIZE 13	
	A	0.11 GPM	1.1 GPM	5.2 GPM	17 GPM	28 GPM	
	A	25 L/H	250 L/H	1200 L/H	4000 L/H	6500 L/H	
	A	0.49 SCFM	5.2 SCFM	19 SCFM	67 SCFM	100 SCFM	
	A	0.78 NM3/H	8.2 NM3/H	30 NM3/H	100 NM3/H	160 NM3/H	
	B	0.28 GPM	1.7 GPM	6.6 GPM	26 GPM	41 GPM	
	B	65 L/H	400 L/H	1500 L/H	6000 L/H	9500 L/H	
	B	1.2 SCFM	7.7 SCFM	31 SCFM	94 SCFM	160 SCFM	
	B	2 NM3/H	12 NM3/H	49 NM3/H	140 NM3/H	250 NM3/H	
	C	0.59 GPM	2.8 GPM	10 GPM	35 GPM	55 GPM	
	C	130 L/H	650 L/H	2400 L/H	8000 L/H	12000 L/H	
	C	2.4 SCFM	11 SCFM	41 SCFM	150 SCFM	200 SCFM	
	C	3.7 NM3/H	18 NM3/H	65 NM3/H	230 NM3/H	310 NM3/H	
	D	0.88 GPM	4.4 GPM	15 GPM	46 GPM	88 GPM	
	D	200 L/H	1000 L/H	3500 L/H	10000 L/H	20000 L/H	
	D	3.7 SCFM	21 SCFM	65 SCFM	210 SCFM	390 SCFM	
	D	5.8 NM3/H	33 NM3/H	100 NM3/H	330 NM3/H	620 NM3/H	
	CODE	CONNECTION TYPE					
	1	NPT (F) with Viton O'Ring (Sizes 7-13 only; up to 350 oF (177 oC))					
	2	NPT (F) with Teflon O'Ring (Sizes 7-13 only; up to 450 oF (232 oC))					
	A	ANSI 150# RF					
	B	ANSI 300# RF					
	D	DIN PN40					
		METER ACCURACY/SCALE INSCRIPTION/FLUID					
	CODE	METER ACCURACY	SCALE INSCRIPTION		FLUID		
	N	5% FULL SCALE	% SCALE		LIQUID		
	P	5% FULL SCALE	DIRECT		LIQUID		
	Q	5% FULL SCALE	% SCALE		GAS		
	R	5% FULL SCALE	DIRECT		GAS		
	S	5% FULL SCALE	% SCALE		LIQUID HIGH VISCOSITY (SEE CAPACITY TABLE FOR LIMITS)		
	T	5% FULL SCALE	DIRECT		LIQUID HIGH VISCOSITY (SEE CAPACITY TABLE FOR LIMITS)		
	7	5% FULL SCALE	Dual Scales % and/or Direct*		LIQUID		
	8	5% FULL SCALE	Dual Scales % and/or Direct*		GAS		
	9	5% FULL SCALE	Dual Scales % and/or Direct*		LIQUID HIGH VISCOSITY (SEE CAPACITY TABLE FOR LIMITS)		
	*Dual inscription scales are not available with any 4-20 mA transmitter options						

3810A 1 2 A 1

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Table 4 Ordering Information and Model Code (Continued)

INDICATION CONFIGURATION				
CODE	HOUSING	MATERIAL	FINISH	INDICATOR FUNCTION
A	Standard	Aluminum	Polyurethane	Indictor only
B	Standard	Aluminum	Polyurethane	Inductive Alarm only, 1 Switch
C	Standard	Aluminum	Polyurethane	Inductive Alarm only, 2 Switches
D	Standard	Aluminum	Polyurethane	4-20 mA uP Transmitter only
E	Standard	Aluminum	Polyurethane	4-20mA uP Xmtr & Inductive Alarm 1 Sw
F	Standard	Aluminum	Polyurethane	4-20mA uP Xmtr & Inductive Alarm 2 Sw
G	Standard	Aluminum	Polyurethane	4-20mA uP Xmtr w/Pulse Output & Alarm Contacts
1	Ex. Proof	Aluminum	Epoxy	Inductive Alarm only, 1 Switch
2	Ex. Proof	Aluminum	Epoxy	Inductive Alarm only, 2 Switch
3	Ex. Proof	Aluminum	Epoxy	4-20 mA uP Transmitter only
4	Ex. Proof	Aluminum	Epoxy	4-20mA uP Xmtr & Inductive Alarm 1 Sw
5	Ex. Proof	Aluminum	Epoxy	4-20mA uP Xmtr & Inductive Alarm 2 Sw
6	Ex. Proof	Aluminum	Epoxy	4-20mA uP Xmtr W/Pulse Output & Alarm Contacts
RELAY/POWER SUPPLY OPTIONS				
A	None			
B	Power Supply Relay Unit - 220VAC - 1 Channel (For use with inductive alarms only)			
C	Power Supply Relay Unit - 220VAC - 2 Channel (For use with inductive alarms only)			
D	Power Supply Relay Unit - 110VAC - 1 Channel (For use with inductive alarms only)			
E	Power Supply Relay Unit - 110VAC - 2 Channel (For use with inductive alarms only)			
F	General Purpose Power Supply, 24 VDC (For use with 4-20mA transmitter only)			
G	General Purpose Power Supply, 110VAC Input (For use with 4-20mA transmitter only)			
H	General Purpose Power Supply, 220VAC Input (For use with 4-20mA transmitter only)			
J	Intrinsically Safe Power Supply, 24Vdc Input (For use with 4-20mA transmitter only)			
K	Intrinsically Safe Power Supply, 110Vdc Input (For use with 4-20mA transmitter only)			
L	Intrinsically Safe Power Supply, 220Vdc Input (For use with 4-20mA transmitter only)			
CERTIFICATIONS				
1	None			
A	Certificate for NIST Traceability			
B	Certificate acc. N.A.C.E. MR-01-75			
G	Certificate for NIST Traceability & N.A.C.E. MR-01-75			
ACCESSORIES (NOTE 3 & 4)				
CODE			METER LIMITATIONS	
A	None			
N	1/4" Valve on Inlet (1/4" in with 1/2" out)		Size 7, float codes A, B, & C only	
P	1/4" Valve on Outlet (1/2" in with 1/4" out)		Size 7, float codes A, B, & C only	
Q	1/2" Valve on Inlet		Size 7, float code D; Size 8, float codes A, B & C only	
R	1/2" Valve on Outlet		Size 7, float code D; Size 8, float codes A, B & C only	
S	1" Valve on Inlet		Size 8, float code D; Size 10, float codes A & B only	
T	1" Valve on Outlet		Size 8, float code D; Size 10, float codes A & B only	
U	Sight Flow Indicator Mounting Hardware		Flanged units all sizes; NPT up to size 13 (2")	
V	Sight Flow Indicator Mounting Hardware		Flanged units all sizes; NPT up to size 13 (2") Flanged units all sizes; NPT up to size 13 (2")	
SOFTWARE REVISION LEVEL (for uP Transmitter)				
1	Not Applicable - uP Transmitter not part of meter			
A	Initial Release			

NOTE 3: ACTUAL SIGHT FLOW INDICATOR UNITS MUST BE ORDERED AS SEPARATE LINE ITEMS.

3810A12A1 A A B A NOTE 4: VALVES AVAILABLE WITH NPT CONNECTIONS ONLY

Data Sheet

DS-VA-MT3810-eng

March, 2008

Brooks® Model MT 3810

Table 4 Ordering Information and Model Code (Continued)

APPROXIMATE SHIPPING WEIGHT LBS (KG):	METER SIZE			
	7-8	10	12	13
WEIGHT 150# R.F. flange w/ indicator only	6 (2.7)	10 (4.5)	15 (6.8)	20 (9)
WEIGHT 150# R. F. flange w/transmitter	7 (3.1)	11 (5)	16 (7.2)	21 (9.5)
WEIGHT 150# R. F. flange w/inductive alarms	7 (3.1)	11 (5)	16 (7.2)	21 (9.5)
WEIGHT NPT (F) w/ indicator only	3 (1.3)	7 (3.1)	12 (5.4)	14 (6.3)
WEIGHT NPT (F) flange w/transmitter	4 (1.8)	8 (3.6)	13 (5.9)	15 (6.8)
WEIGHT NPT (F) flange w/inductive alarms	4 (1.8)	8 (3.6)	13 (5.9)	15 (6.8)

TRADEMARKS

Brooks Brooks Instrument, LLC
HART HART Communications Foundation
Smart Meter Manager Brooks Instrument, LLC
SMM Brooks Instrument, LLC
Teflon E.I. DuPont de Nemours & Co.
Viton DuPont Performance Elastomers

Brooks® Model MT 3810

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Brooks Instrument can provide start-up service prior to operation when required. For some process applications, where ISO-9001 Quality Certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

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