

***Model: CAT3***  
***DC or AC Powered Microprocessor***  
***Controlled Transmitter***

**USER'S MANUAL**



**HP-312**  
**August 2023**

***HOFFER***  
***Flow Controls***

**Perfecting Measurement™**

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Please review the complete model number of each item to be connected and locate the appropriate manual(s) and/or drawing(s). Identify all model numbers exactly before making any connections. A number of options and accessories may be added to the main instrument, which are not shown on the basic user wiring. Consult the appropriate option or accessory user manual before connecting it to the system. In many cases, a system wiring drawing is available and may be requested from HOFFER FLOW CONTROLS.

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FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting HOFFER FLOW CONTROLS:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

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1. P.O. number to cover the COST of the repair/calibration,
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If HFC's inspection reveals the goods are free of defects in material and workmanship or such inspection reveals the goods were improperly used, improperly installed, and/or improperly selected for service intended, HFC will notify the purchaser in writing and will deliver the goods back to Purchaser upon (i) receipt of Purchaser's written instructions and (ii) the cost of transportation. If Purchaser does not respond within thirty (30) days after notice from HFC, the goods will be disposed of in HFC's discretion.

HFC does not warrant these goods to meet the requirements of any safety code of any state, municipality, or other jurisdiction, and Purchaser assumes all risk and liability whatsoever resulting from the use thereof, whether used singly or in combination with other machines or apparatus.

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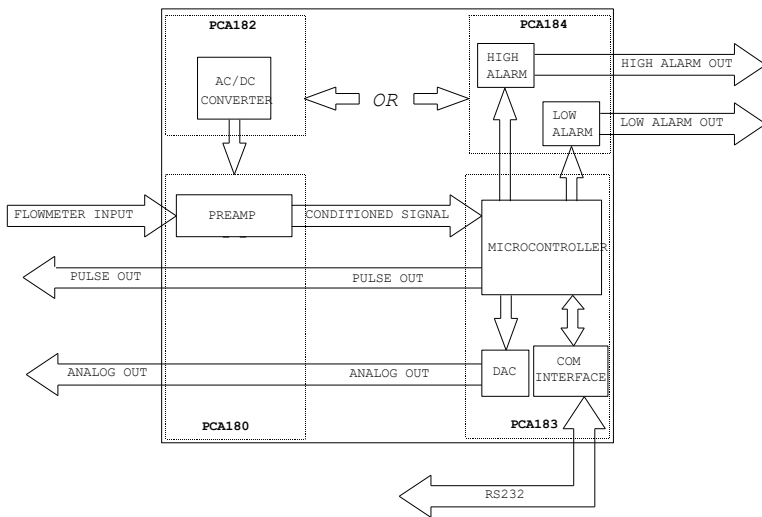


# 1. Introduction

The CAT3 is a versatile DC or AC powered microprocessor-based transmitter, which provides pulse output, analog output and High/Low flow alarm options. Up to 3 circuit boards may be installed to provide a variety of input/output options.

The flowmeter input circuitry will accept a variety of signal types including, low level sinusoidal, MCP/RF, pulse and contact closure. Optional 20-point linearization is available to correct for flowmeter non-linearities, improving overall system accuracy. The CAT3 is compatible with all Hoffer turbine flowmeters as well as the H.O.G. series positive displacement flowmeters.

## CAT3 Block Diagram

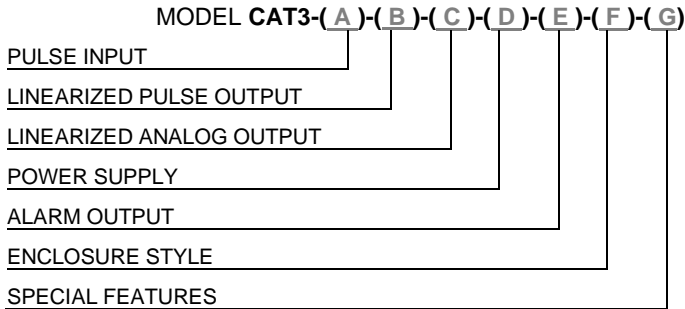


An RS232 communications port located under the top plate allows CAT3 to be remotely configured using DevConfig 3.0, a PC application program that is included with all units.

## **2 Introduction**

The standard unit is packaged in an extruded aluminum enclosure for wall mounting or may be mounted directly on a flowmeter using an optional NEMA 4X or EX enclosure. An optional bracket is also available for mounting on standard DIN rail.

## 1.1 Model Number Designation



### PULSE INPUT

MODEL CAT3-(A)-( )-( )-( )-( )-( )-( )

#### OPTION ( A )

- (1) MAG COIL, PULSE, DRY CONTACT
- (2) MC3P
- (3) ISOLATED PULSE, RPM, RPR AND HALL EFFECT COILS

### LINEARIZED PULSE OUTPUT

MODEL CAT3-( )-(B)-( )-( )-( )-( )-( )

#### OPTION ( B )

- (1) 0-5 TTL / CMOS
- (2) OPEN COLLECTOR
- (3) OPEN COLLECTOR WITH PULL UP TO V+
- (4) AC SQUARE WAVE
- (5) 0-10V SQUARE WAVE

**NOTE:** NOT RECOMMENDED FOR USE AS A FLOW RATE SIGNAL.  
MAXIMUM INPUT SENSOR FREQUENCY ALLOWED IS 100HZ.

### LINEARIZED ANALOG OUTPUT

MODEL CAT3-( )-( )-(C)-( )-( )-( )-( )

#### OPTION ( C )

- (1) 4-20 MA
- (5) 1-5 VDC

### POWER SUPPLY

MODEL CAT3-( )-( )-( )-(D)-( )-( )-( )

#### OPTION ( D )

- (DC) 13-30 VDC
- (AC) 100-240 VAC

**NOTE:** WHEN (AC) IS SELECTED, THE ALARM OPTION IS NOT AVAILABLE.  
USE REMOTE ACC39B POWER SUPPLY IF REQUIRED.

## 4 Introduction

### ALARM OUTPUT

MODEL CAT3-( )-( )-( )-( )-(E)-( )-( )

#### OPTION ( E )

- (4) HIGH OPEN COLLECTOR
- (5) HIGH TTL / CMOS
- (6) HIGH RELAY ONE SPDT, CONTACT RATED @ 2A 30V
- (7) LOW OPEN COLLECTOR
- (8) LOW TTL / CMOS
- (9) LOW RELAY ONE SPDT, CONTACT RATED @ 2A 30V

**NOTE: WHEN ALARM OPTION IS SELECTED, (AC) POWER IS NOT AVAILABLE.  
USE REMOTE ACC39B POWER SUPPLY.**

### ENCLOSURE STYLE

MODEL CAT3-( )-( )-( )-( )-( )-(F)-( )

#### OPTIONS ( F )

- (1) GENERAL PURPOSE.  
2.6"L X 2.6"H X 2.6"W MINIMUM MOUNTING SPACE.
- (D) 2" LONG DIN RAIL MOUNT SINGLE UNIT.  
UP TO 20 CAT3 UNITS CAN BE MOUNTED ON A SINGLE  
RAIL. ADD 2" PER UNIT.
- (E3) EXPLOSION-PROOF (ALL CONDUIT PORTS ARE ¾" FNPT)
- (E3M) EXPLOSION-PROOF (CONDUIT PORTS D2 & D3 = M20 THR'D;
- (E4)\* EXPLOSION-PROOF - FOR USE WITH AC POWERED CAT ONLY  
(NOT Ex d SYSTEM CERTIFIED)  
\*FOR Ex d CERTIFIED SYSTEM USE E6 OR E6M ENCLOSURE
- (E6) EXPLOSION-PROOF STAINLESS STEEL  
(ALL CONDUIT PORTS ARE ¾"FNPT)
- (E6M) EXPLOSION-PROOF STAINLESS STEEL (M20 NOT AVAILABLE FOR CANADA)

**NOTE: FOR UL LISTED EXPLOSION-PROOF APPLICATIONS CONTACT FACTORY.**

**SPECIAL FEATURES**

MODEL CAT3-( )-( )-( )-( )-( )-( )-(G)

**OPTIONS ( G )**

- (CE) MARK REQUIRED FOR EUROPE
- (SP) ANY SPECIAL FEATURES THAT ARE NOT COVERED IN THE MODEL NUMBER, USE A WRITTEN DESCRIPTION OF THE -SP
- (MIL) DESIGNED TO MEET EMC STDS EN5011-1992 AND EN61326-1:1997
- (CFX) 6.75" LONG RISER AND UNION FOR EXPLOSION-PROOF **SYSTEM CERTIFIED ENCLOSURES** MOUNTED ON TURBINE. USED WITH "X" RISER TURBINE OPTION AND (EXP) OR (EX) SPECIAL FEATURES OPTION UNDER FLOWMETERS AS FOLLOWS:  
 (EXP) FOR CANADIAN INSTALLATION OR  
 (EX) FOR NON-CANADIAN INSTALLATION.
- NOTE: IF PROCESS TEMP IS < -40°C AND > 79°C, EX-PROOF ENCLOSURE MUST BE MOUNTED REMOTELY.**
- (C) REMOTED MOUNTED FOR EXPLOSION-PROOF **SYSTEM CERTIFIED ENCLOSURE**. FOR USE WITH (C-EXP) OR (EX) SPECIAL FEATURES UNDER FLOWMETERS AS FOLLOWS:  
 (EXP) FOR CANADIAN INSTALLATION OR  
 (EX) FOR NON-CANADIAN INSTALLATION.
- NOTE: "X" RISER, CERTIFIED UNION, REDUCER AND ENCLOSURE (TO BE SPECIFIED) MOUNTED ON FLOWMETER**
- (X) NO SPECIAL FEATURES

**STYLE E3, E3M, E6 AND E6M SYSTEM CERTIFIED RATINGS ONLY  
APPLY TO "CFX" OR "C" OPTIONS:**

- CSA/FM: CLASS I, DIV. 1, GR. BCD; CLASS II, DIV. 1, GR. EFG;  
 CLASS III, TYPE 4X,  
 CLASS 1 ZONE 1 AEx db IIB + H2 T6/T5 Gb,  
 Ex d IIB+H2 T6/T5; Gb; Ex tb T80°C/T86°C IIIC Db; IP66  
 CLASS I, ZONE 21 AEx tb T80°C/T86°C IIIC Db; IP 66
- ATEX/IECEx: II 2 G Ex db IIB + H2, T6/T5 Gb  
 II 2 D Ex tb IIIC T80°C/T86°C Db; IP66  
 T6: -40°C ≤ Ta ≤ 79°C; T5: -40°C ≤ Ta ≤ 85°C

- NOTES: 1. IF ENCLOSURE IS MOUNTED ON TURBINE FLOWMETER, RISER MUST BE SPECIFIED ON METER.
2. PULSE SCALING IS SUPPLIED AS A STANDARD IN THE BASE PRISE AND IS SCALED TO THE UNIT MEASURE.
3. WINDOWS® BASED SETUP AND CABLE KIT CONSISTS OF:  
 1 EA. HIT2A-301  
 1 EA. CABLE MODEL 26886  
 DEVICE CONFIGURATION DOWNLOAD IS AVAILABLE AT HOFER FLOW CONTROLS WEBSITE UNDER "MANUALS & PROGRAMS" AND UNDER "CONFIGURATION PROGRAMS".  
**IF THE CAT IS SHIPPED UN-CALIBRATED, THIS MUST BE ORDERED TO CALIBRATE OR RE-CALIBRATE IN THE FIELD.**

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## 2. Specifications

### General Specifications

Input Signal Type:	Magnetic pick up, MCP pick up, Contact Closure, Pulse
Input Frequency Range:	0.2 Hz to 4 KHz
Signal Level:	10 mV rms to 30 Vdc
Power Supply:	13-30 Vdc (Reverse polarity protected) 100-240 Vac (Fuse rating 0.5A, 250 Vac)
Analog Output:	4-20mA, 1-5V
Analog Output Response Time:	1/8 sec.*
Load Resistance:	Max 650 Ohms at 24 Vdc
Accuracy:	+/- 0.02% of full scale @ 20° C
Temperature Drift:	40ppm/deg C
Pulse Output:	0-5, 0-10V, Open Collector, AC square Internal pull-up resistor 2.7k Ohms Recommended load min. 50k Ohms
Maximum Pulse Frequency:	1, 2, 4, 8, 100, 50% Duty Cycle
Pulse Scaling:	Per flow unit of measure, divide by 1, 10, 100
Hi/Lo Alarm:	Relay (2A, 30 Vdc), 0-5V, Open Collector (0.5A, 30 Vdc)
Communications:	RS232 port for Configuration and diagnostics
Operating Temperature:	T5 and STD: $-40^{\circ} \leq T_a \leq 85^{\circ} \text{ C}$ T6: $-40^{\circ} \leq T_a \leq 79^{\circ} \text{ C}$
Humidity:	0-90% Non-condensing
Enclosure:	Extruded aluminum DIN rail mount Explosion Proof
Regulatory:	CE compliant

\*Limited by signal frequency and MST settings. Refer to Section 3.4.

### Options

20 Point Linearization

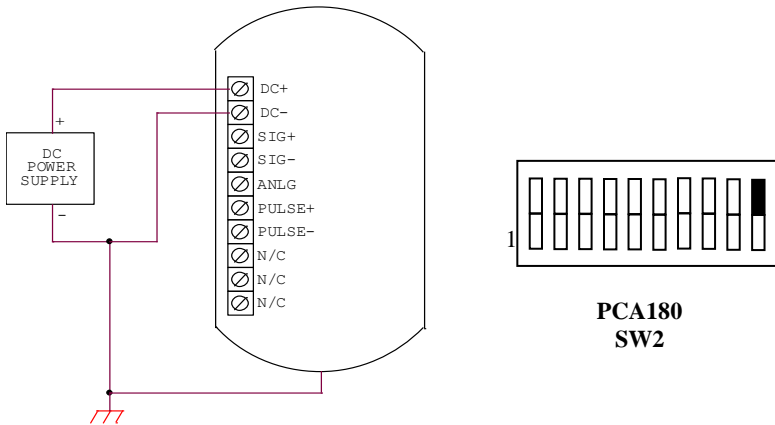
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## 3. Installation and Operation

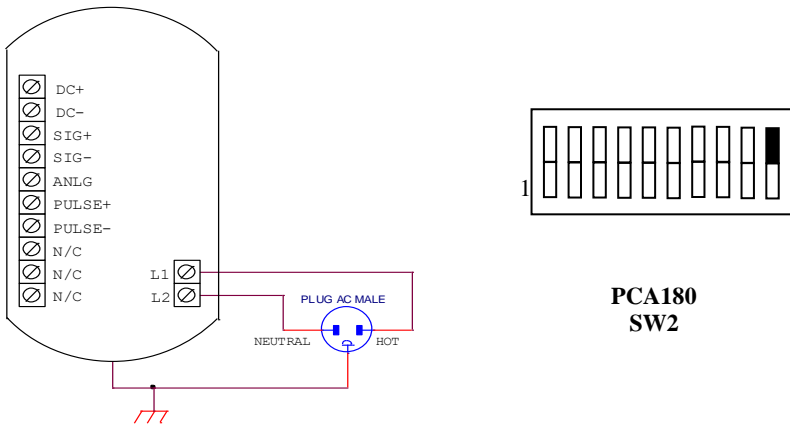
### 3.1 Power Supply

#### DC Power (13-30 VDC)



#### AC Power (100-240 VAC)

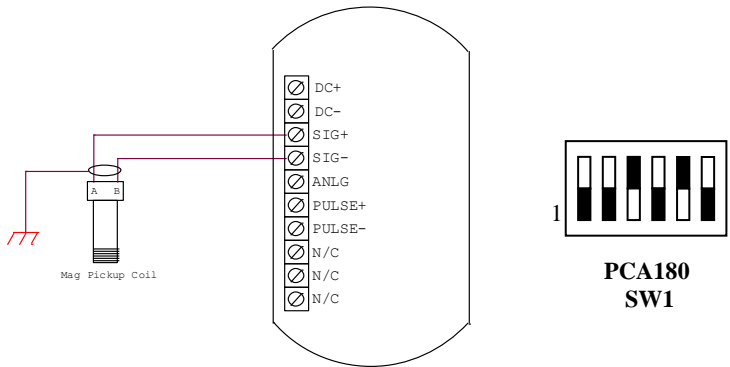
AC power for CAT3 requires an optional circuit board, PCA182. The Alarm option (PCA184) is not available when the AC Power option is equipped.



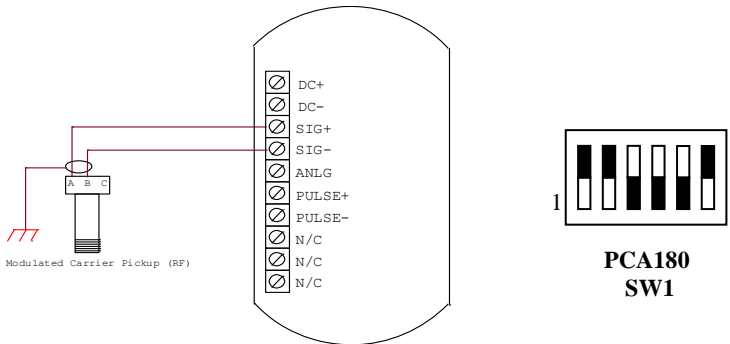
3.2      **Flowmeter Input**

The Preamp circuitry for conditioning the flow signal is located on PCA180. The following drawings illustrate typical connections and switch settings on PCA180 for various input signals.

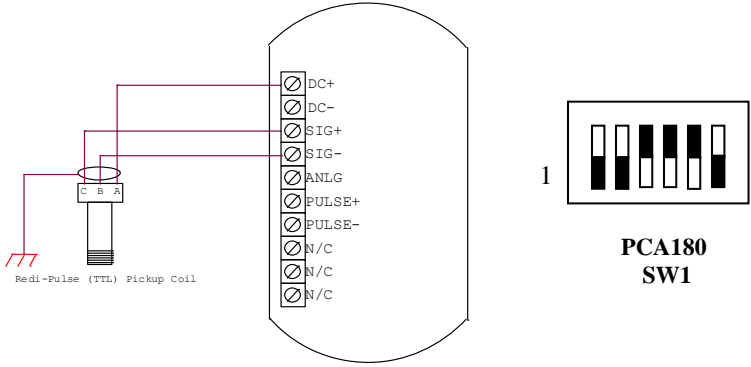
Magnetic Pickup Coil



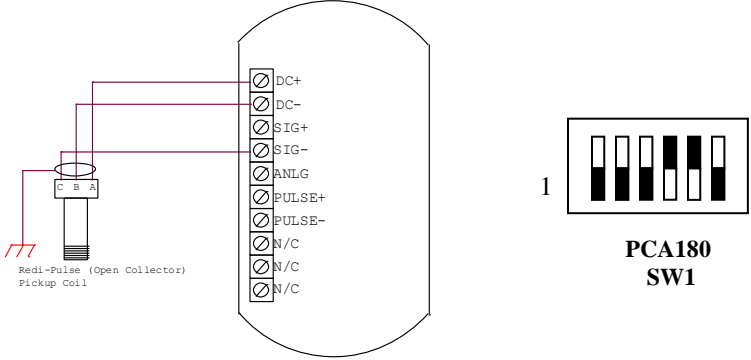
MCP/RF Coil



Redi-Pulse (TTL Pulse)



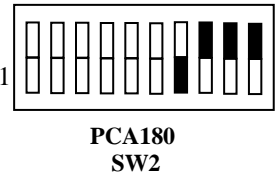
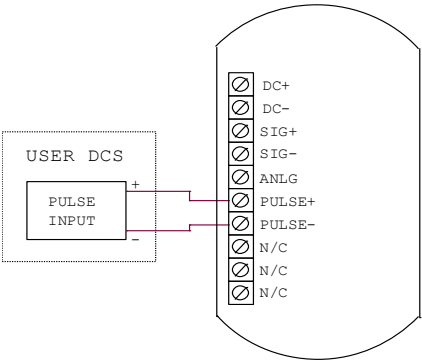
Redi-Pulse (Open Collector)



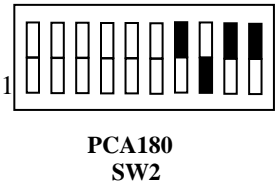
3.3     Pulse Output

CAT3 provides a Pulse Output option that is scaled per flow unit of measure by a factor of 1, 10 or 100. Pulse output frequency varies with flow rate. The maximum frequency can be set at 1, 2, 4, 8, 100 Hz. The following drawings illustrate typical connections and switch settings for various pulse output options.

TTL(0-5V), 0-10V, High Level (DC In), AC Square

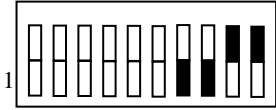
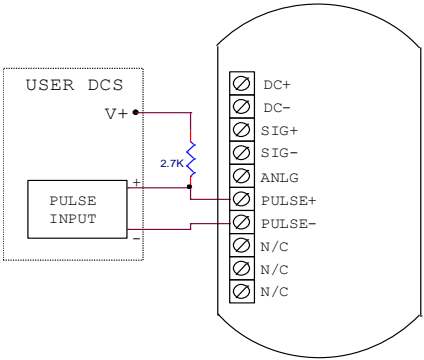


TTL(0-5V), 0-10V, AC Square



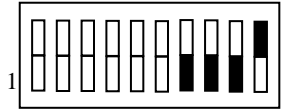
High Level Pulse, AC Square

Open Collector, Isolated Pulse



**PCA180  
SW2**

Open Collector



**PCA180  
SW2**

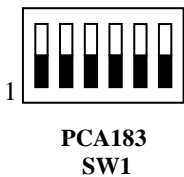
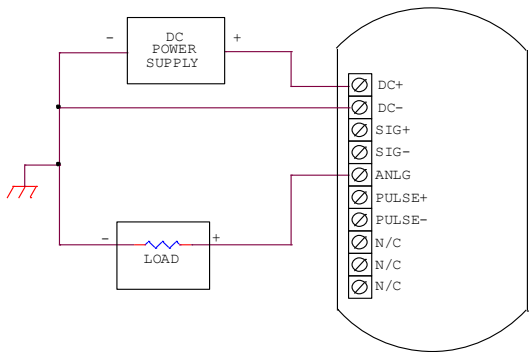
Isolated Pulse

14 Installation and Operation

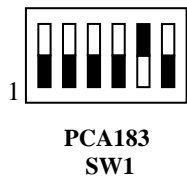
3.4 Analog Output

CAT3 provides an Analog Output option that will output an analog current or voltage that is proportional to the flow rate.

Analog Output – DC Power

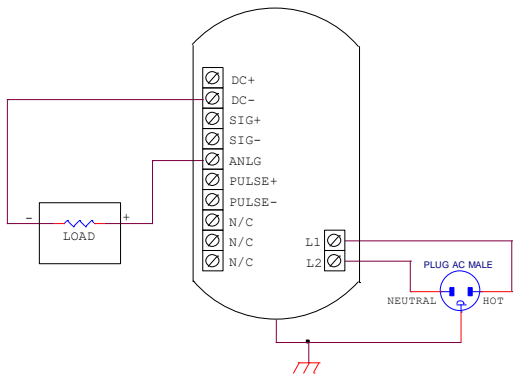


4–20 mA Output



1-5 V Output

Analog Output – AC Power



The Microcontroller, located on PCA183, accepts the square-wave output of the preamplifier and performs all of the calculations that are required to control the Loop Driver. After measuring the frequency of the square-wave, the Microcontroller uses the following equations to compute the flow rate and current.

$$flowrate = \frac{frequency}{Kfactor} \times 60^{FM} \times CF$$

Where:

- Kfactor = Is dependent on the Flow Calculation Method setting and is either the Average K-Factor or the Linearized K-Factor from the Frequency / K-Factor table.
- FM = Is the Flow rate Units setting of 0, 1, or 2. Where “0” is for Seconds, “1” is for Minutes, and “2” is for Hours.
- CF = Is the Correction Factor setting.

$$current = 4mA + \left( 16mA \times \frac{flowrate}{AF} \right)$$

Where:

- AF = Is the 20mA maximum Flow rate value.

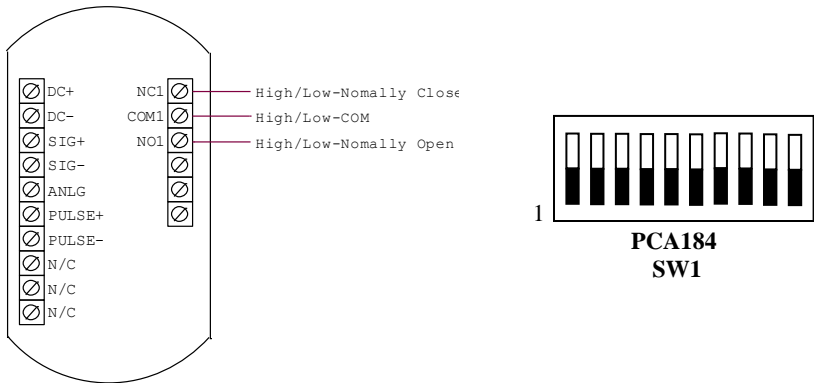
If the calculated flowrate is greater than the AF setting, the current will be set to 24mA to indicate an “Over-range” condition. After calculating the current, the Microcontroller digitally sends the current information to the Loop Driver. The loop driver, located on PCA183, uses the digital information sent to it by the Microcontroller to set the current of the loop. The Loop Driver also supplies power to the Microcontroller.

The analog output response time to reach steady state due to a change in the flow rate is approximately 1/8 of a second. When flow stops, the time for the analog output to return to 4 mA will be between .25 and 8 seconds, depending on the Maximum Sample Time (MST) setting. MST is adjusted using the NB=(DATA) command, where NB is a value between 1 and 80. The default MST setting is NB= 1. Adjusting the MST is only recommended for low flow applications where the minimum input frequency is below 1 Hz.

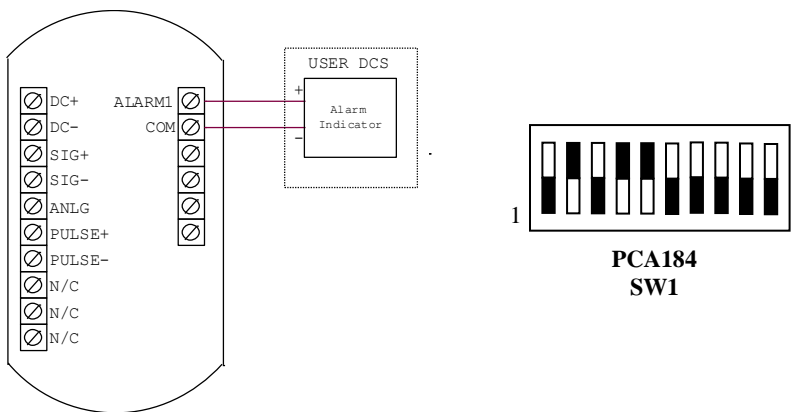
3.5 Alarm Outputs

CAT3 provides an optional High/Low Flow Alarm feature. Alarms require an optional circuit board, PCA184. The Alarm option is not available when the AC Power option is equipped. The drawings below illustrate the typical connections and switch settings for various alarm options.

Hi/Lo Alarm Relay

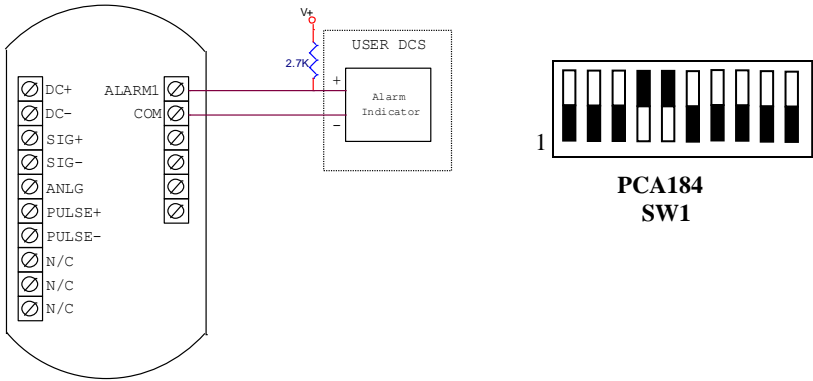


Hi/Lo Alarm TTL(0-5V)





# Hi/Lo Alarm Open Collector



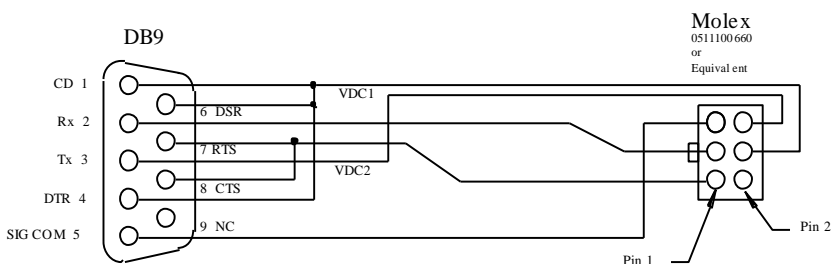
### 3.6 Communications Port

CAT3 is equipped with RS232 serial communication port for changing CAT3 configuration, diagnostics functions, and flow monitoring. Hoffer communication program DevConfig 3.0 must be used to communicate with CAT3.

The RS232 serial port connector is located under the top plate of CAT3 and may be accessed by removing the two screws from the top plate. A matching connector is provided with HOFFER HIT2A-301 Communications Cable. CAT3 unit has to be powered from external supply in order to be able to communicate. Additional power for CAT3 communication circuitry is supplied by the RS232 serial port of the computer/terminal. COM port settings must be set as follows:

Baud Rate: 2400  
 Data Bits: 8  
 Parity: None  
 Stop bits: 1  
 Handshaking: None

#### HOFFER HIT2A-301 Communications Cable



### 3.7 Wiring

When installing CAT3, it is a good practice to use shielded cables for all input and output signals. The shield should be connected to the earth ground lug on the CAT3. The shield on the opposite end of the cable should be left open. Connections are made to the CAT3 terminal blocks using wire gauges 16 to 28 AWG and 12 to 26 AWG (AC Power), tightening Torque 0.22 to 0.25Nm.

This wiring practice is mandatory in order to comply with the requirements for Electromagnetic Compatibility, as per EMC-Directive 2014/30/EU of the Council of European Community.

## **APPENDIX A - Default Configuration**

<b>FIELD</b>	<b>Value</b>
FLOW CALC. METHOD	0 (Average)
K-FACTOR DECIMAL	3
AVERGAE K-FACTOR	1.00
NUMBER OF POINTS IN K-TABLE	10
FREQUENCY 01	4999.981
FREQUENCY 02	4999.982
FREQUENCY 03	4999.983
FREQUENCY 04	4999.984
FREQUENCY 05	4999.985
FREQUENCY 06	4999.986
FREQUENCY 07	4999.987
FREQUENCY 08	4999.988
FREQUENCY 09	4999.989
FREQUENCY 10	4999.990
FREQUENCY 11	4999.991
FREQUENCY 12	4999.992
FREQUENCY 13	4999.993
FREQUENCY 14	4999.994
FREQUENCY 15	4999.995
FREQUENCY 16	4999.996
FREQUENCY 17	4999.997
FREQUENCY 18	4999.998
FREQUENCY 19	4999.999
FREQUENCY 20	5000.000
K-FACTOR 01	1.00
K-FACTOR 02	1.00
K-FACTOR 03	1.00
K-FACTOR 04	1.00
K-FACTOR 05	1.00
K-FACTOR 06	1.00
K-FACTOR 07	1.00
K-FACTOR 08	1.00
K-FACTOR 09	1.00
K-FACTOR 10	1.00
K-FACTOR 11	1.00
K-FACTOR 12	1.00
K-FACTOR 13	1.00
K-FACTOR 14	1.00
K-FACTOR 15	1.00
K-FACTOR 16	1.00
K-FACTOR 17	1.00
K-FACTOR 18	1.00
K-FACTOR 19	1.00
K-FACTOR 20	1.00
MEASURING UNITS	GAL
FLOW RATE TIME UNITS	MIN
MAX SAMPLE TIME	01
ANALOG OUTPUT LOW	0.000
ANALOG OUTPUT HIGH	100.000
PULSE SCALE	OFF
PULSE FREQUENCY	100
ALARM FUNCTION	Off
ALARM LEVEL	100.000

# APPENDIX B - Declaration of Conformity



## EU Declaration of Conformity – CAT Series Transmitters

Manufacturer: Hoffer Flow Controls Inc, 107 Kitty Hawk Ln, Elizabeth City, NC 27909

Equipment: Flame Proof Transmitters

Designation/Model: CAT1-X-X-X-X, CAT2-X-X-X-X-X-X and CAT3-X-X-X-X-X-X

NOTE: "X" in Model number may be any combination of numbers and characters representing specific options.

Marking: With Aluminum Explosion Proof Enclosure

Class I, Division 1, Groups BCD; Class II, Division 1, Groups E,F,G; Class III; Type 4X;

Ex d IIB+H<sub>2</sub> T6/T5; Gb; Ex tb T80°C/T86°C IIIC Db; IP66;

Class I, Zone 1, AEx db IIB+H<sub>2</sub> T6/T5; Gb; Class I, Zone 21, AEx tb T80°C/T86°C IIIC Db; IP66:

II 2 G Ex db IIB+H<sub>2</sub> T6/T5 Gb

II 2 D Ex tb IIIC T80°C/T86°C Db IP66

T6 = -40°C to +79°C; T5 = -40°C to +85°C

Seal within 50mm of enclosure.

Marking: With Stainless Steel Enclosure

Class I, Division 1, Groups BCD; Class II, Division 1, Groups E,F,G; Class III; Type 4X;

Ex d IIB+H<sub>2</sub> T6/T5; Gb; Ex tb T80°C/T86°C IIIC Db; IP66;

Class I, Zone 1, AEx db IIB+H<sub>2</sub> T6/T5; Gb; Class I, Zone 21, AEx tb T80°C/T86°C IIIC Db; IP66:

II 2 G Ex db IIB+H<sub>2</sub> T5/T6 Gb

II 2 D Ex tb IIIC T86°C Db IP66

T6 = -40°C to +79°C; T5 = -40°C to +85°C

Seal within 18" of enclosure.



This declaration of conformity is issued under the sole responsibility of the manufacturer. The object of the declaration is in conformity with the relevant Union harmonisation Legislation. We hereby declare that the product, which is subject of this declaration, is in conformity with the following standards:

ATEX	ATEX Directive 2014/34/EU: Equipment and protective systems intended for use in potentially explosive atmospheres. Applicable Standards - EN 60079-0:2017; EN 60079-1:2014 and EN 60079-31:2014	EU-Type Examination Certificate: Sira 16 ATEX 1086 X
CSA	Applicable CSA Requirements: CSA C22.2 No. 0-10, CSA C22.2 no. 142-M1987, CSA C22.2 No. 25-1966 (R2014), CSA C22.2 No. 30-M1986 (R2012), UL 508, CAN-CSA 60079-0:11, 60079-1:11 60079-39:12, FM 3600, FM 3615, FM 3616, UL 60079-0:2013, 60079-1: 2015 and 60079-31:2015	CSA-Type Examination Certificate:
IECEx	IEC Certification for Explosive Atmospheres. Applicable Standards IEC 60079-0:2017 IEC 60079-1:2014 and IEC 60079-31:2013	IECEx CSA 16.0016X

EU-Directive 2014/34/EU Annex IV/IECEx Certificate issued by:

The Certification Body for Explosion Protection  
 of TÜV Rheinland Industrie Service GmbH

Certificate No.: 01 220 1609028      Notified Body Number: 0035

EU type examination certificate issued by: Certificate: Sira 16 ATEX 1086 X CSA Group Netherlands B.V. Utrechseweg 310 6812 AR Arnhem Netherlands	CSA-Type Examination Certification issued by: CSA Group Testing & Certification Inc. Edmonton, AB, Canada T6N 1E6
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Date: 12/11/2020

John DeFeo, Compliance Engineer  
 Hoffer Flow Controls, Inc.

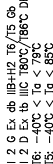
## **APPENDIX C - Installation and Conditions for Safe Use Drawings for Certified Systems**



CL1, DIV.1, GRB,C,D  
CL1, DIV.1, GRF,F,G; CL11; TYPE 4X  
CL1, ZONE 1 AEX db IIB-H2 T6/T5; G5  
EX db IIB-H2 T6/T5; G5; EX db T80C/T86C IIC Db IP66  
CLASS 1, ZONE 21 AEX db T80C/T86C IIC Db; IP66  
A SEAL SHALL BE INSTALLED WITHIN 50mm OF ENCL.  
T6: -40° < Ta < 79°; T5: < -40° < Ta < 85°  
USE WIRE RATED 90° OR HIGHER

NOTE: FLOWMETER PROCESS FITTING -  
AVAILABLE OPTIONS: MS FLARE PER MS33656,  
NPT, FLANGED, GROOVED AND WAFER.

[illegible]









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