INSTRUCTION
MANUAL

YEWFLO

(Style E)

Model YF100
Vortex Flowmeter
(Integral Type, Remote Type)

Model YFA11
Vortex Flow Converter
(Remote Type)

IM 1F2B4-01-YIA

YOKOGAWA
Yokogawa Industrial Automation

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

I. INTRODUCTION

1.1 General Overview

This manual provides installation, parameter setting, calibration, maintenance and troubleshooting instructions for the YEWFLO Vortex flowmeter. Also included are standard specifications, model code definitions, dimensional drawings and a parts lists.

All YEWFLO's are shipped pre-configured for your application. Therefore, if you included correct process conditions with your order, **no electronic setup or parameter setting is required.** For piping and wiring connections, refer to the Installation section.

If your process conditions have changed since your order was placed, please refer to the **'QUICK START'** section which is designed to simplify configuration of the YEWFLO software parameters. Please refer to the index for immediate access to a specific procedure or the glossary located at the end of this manual for further information on a specific term.

If you have any questions concerning the YEWFLO you received, please contact your local Yokogawa Industrial Automation Representative or our headquarters office in Newnan, GA at 770-254-0400.

If you have technical questions regarding the installation, operation, setup or application of a YEWFLO, please contact our Technical Assistance Center (TAC) at 800-524-SERV.

Yokogawa has manufactured this instrument according to rigorous ISO 9000 quality standards. To ensure quality performance we recommend referencing our YEWFLO sizing program to determine the level at which your application should be run as well as a straight meter run of 20 diameters upstream and 5 diameters downstream. In addition to these suggestions, please follow the instructions in this manual carefully.

We are not responsible for any instrument's performance, if that instrument has not been properly applied or installed in accordance with this manual, nor can we be responsible for the performance of any instrument which has been modified or repaired by an unauthorized service center.

Note: Existing YEWFLO Style C vortex flowmeters may be upgraded to provide the features and benefits of the *New* microprocessor-based Style "E" YEWFLO.

1.2 Principle of Operation

1.2.1 Vortex shedding

How many of you have seen a flag flapping in the breeze on a windy day? Everybody has. How many of you have noticed that the flag flaps faster as the wind blows faster? Few haven't. When you see a flag flapping in the breeze, you are witnessing the same phenomenon that makes a vortex flowmeter work. The flapping frequency is proportional to the velocity of the wind, and it's linear! The flapping is caused by a vortex alternately being created on either side of the flag, and moving downstream with the wind. The vortex is a swirl of low pressure, like a tornado, that pulls the flag in the direction of the vortex. The passing of alternating vortices down the length of the flag causes it to flap. The faster the wind blows, the faster these vortices are created, and the faster the flag flaps. **Frequency is proportional to velocity**.

The flapping flag is a familiar example of vortex shedding that everyone should be comfortable with. Here's how it's used in a vortex flowmeter. A non-streamlined part (bluff body) is inserted in the flow stream, this obstruction in the pipe causes vortices to be alternately created (shed). We call this part the 'shedder bar'. The shedder bar in a YEWFLO performs two functions, it creates the vortices, and with the addition of our piezoelectric crystals senses them too. The crystals generate an alternating voltage waveform whose frequency is proportional to fluid velocity. The rest of the magic is taken care of in the electronics.

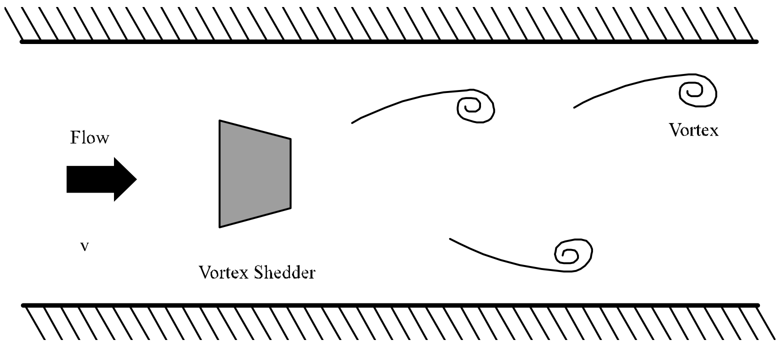


Figure 1.2.1: Karman Vortices

1.2.2 K-factor

The most important fact about vortex shedding is that once the physical geometry, (pipe I.D., shedder bar width, etc.), are fixed, the frequency vs. flowrate (K-factor (pulse/gallon)) is unaffected by changes in viscosity, density or pressure over the operating range of the specific application. To determine the operating range use the YEWFLO Sizing program. On the other hand, an orifice plate is directly affected by changes in any of these parameters. There is a very small temperature effect due to expansion or contraction of the shedder bar width, which is easily compensated. Therefore, the K-factor created in our flow stand (all YEWFLOs are wet flow calibrated) on water, is accurate for gas too! Not so with an orifice plate. The benefit here is **simplified calculations, and fewer things that can effect accuracy** .

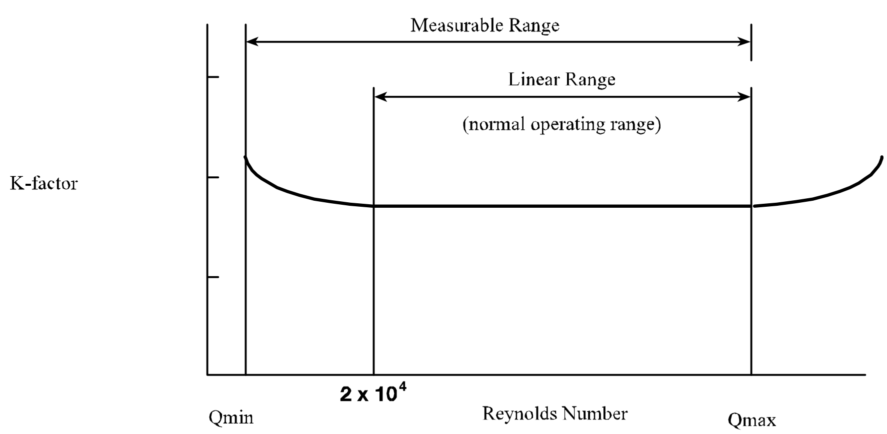


Figure 1.2.2: Relationship between K-factor and Reynolds Numbers

1.2.3 Qmin

Those of you who haven't used many vortex flowmeters may be wondering, 'Why do we need to know viscosity, density, pressure and temperature?'. While the K-factor is unaffected by changes in viscosity, density and pressure, the velocity at which vortices begin to be created and become stable enough to measure accurately will vary. We refer to this velocity as Qmin, stated in desired flow units GPM, SCFH, etc. Here's an example to help you understand. Let's go back to the flag example. We've all seen the flag flapping in the breeze; however, on some days we can feel the breeze blowing, but the flag isn't flapping. Why not? For the flag to flap, there must be enough breeze blowing, or energy, to lift the flag and create fully developed vortices. This is the same thing that happens in the vortex flowmeter.

The higher the fluid viscosity, the higher the velocity (more energy) required to start vortex shedding. On the other hand, the higher the density, the lower the velocity needed to start vortex shedding. In gases, viscosity and density can vary with pressure and temperature. Sounds complicated, but compared to an orifice plate it's quite simple. By using the YEWFLO sizing program, vortex meter selection is simple. Simply enter the process conditions, the program will prompt you for them, and presto, a performance table for all meter sizes is generated. This performance table will help you select the best YEWFLO for the application.

1.2.4 Uniquely vortex

Vortex shedding flowmeters measure flow digitally. This means, amplitude of the vortex signal is unimportant. As long as the flow is above the Qmin threshold, only the presence or absence of a vortex is important. Just like digital electronics, as long as the voltage is above or below a threshold value, it is either on or off. Digital flow measurement means **no zero drift or span shift**. Orifice plate flowmeters, for example, cannot make this claim, even if they are using microprocessor-based digital D/P transmitters, they still measure the small amplitude of deflection caused by differential pressure, and changes in temperature or pressure can shift zero and span.

1.2.5 Vortex frequency

The YEWFLO uses piezoelectric crystals **embedded in the shedder bar**. Note that they are 1) **hermetically sealed**, and 2) surrounded by a **heavy wall thickness**, to protect them from the environment and the process. The positioning of the crystals is important. Although one crystal primarily measures flow frequency, it unfortunately picks up some pipe vibration noise. The other crystal is positioned such that it picks up primarily the pipe vibration noise. By electronically subtracting these two signals, we are able to obtain a **high signal to noise ratio for the flow signal**. The new Style "E" body design also improves the signal to noise ratio, by stiffening the shedder bar mounting in the measurement plane, further isolating it from pipe vibration.

1.2.6 Available outputs

After processing the digital vortex frequency as described above, what outputs can you get? You can select either 4-20 mA output or voltage pulse, digital output. Output is selected by setting jumpers on the amplifier board, and the setting the software for pulse or analog output. Analog output is two-wire, and pulse output is a three-wire connection (for details see the wiring section). The pulse output can be scaled over a range of 0-6000 Hz, down or up to maximize pulse resolution. Scaling up the frequency output can be done to improve resolution. The pulse output is also capable of driving many electromechanical totalizers directly without additional power.

1.3 Standard Specifications

NOTE: For special applications, please contact your local Yokogawa Industrial Automation representative to discuss possible enhancements to these standard specifications.

Fluids to be measured: Liquid, gas or steam

Performance specifications:

Repeatability: 0.2% of reading

Accuracy and velocity range :

Fluid	Accuracy: Pulse Output	Accuracy: Analog Output	Velocity
Liquid	±0.8% of reading	±0.8% of reading plus ±0.1% of full scale	up to 32 ft/sec
Gas or Steam	±0.8% of reading	±0.8% of reading plus ±0.1% of full scale	up to 115 ft/sec
	±1.5% of reading	±1.5% of reading plus ±0.1% of full scale	from 115 ft/sec to 262 ft/sec

Note: Gas accuracy can be improved to 0.8% over the full range by built-in software compensation. (See how to section 4.10.)

Output signal:

Analog: 4 to 20 mADC

Pulse: Low level 0 to 2 V
High level Vs - 2V (Vs = input supply voltage)
Pulse width 50% duty cycle

Ambient temperature limits:

-40º to 175ºF (-40º to 80ºC): standard unit w/o agency approval ratings
-20º to 175ºF (-30º to 80ºC): with optional digital indicator
-40º to 140ºF (-40º to 60ºC): with FM explosion-proof rating
-40º to 120ºF (-40º to 50ºC): with CSA intrinsically safe rating for integral converter
-40º to 175ºF (-40º to 80ºC): with CSA intrinsically safe rating for remote converter

Process temperature limits:

Standard remote converter: -40º to 575ºF (-40º to 300ºC)
HPT remote converter: -40º to 755ºF (-40º to 402ºC)
Cryogenic remote converter: -320º to 300ºF (-200º to 150ºC)
Integral converter: See Figure 1.3.1

Storage temperature limits:

Integral or remote standard unit: -40º to 176ºF (-40º to 80ºC)
With integral indicator or totalizer: -22º to 80ºF (-30º to 140ºC)

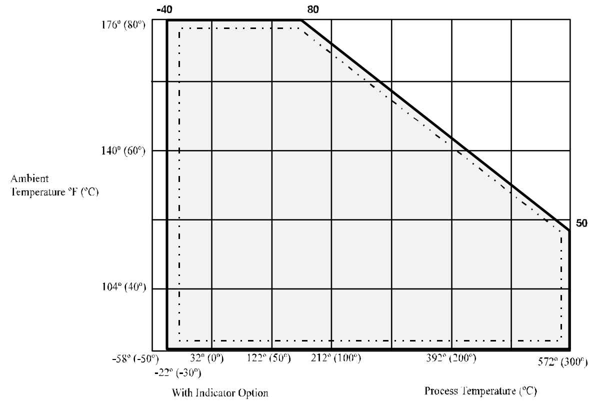


Figure 1.3.1: Operating temperature range for integral type converter

Power supply and load resistance:

Analog output:	17 to 42 VDC (see Figure 1.3.2)
Pulse output:	14 to 30 VDC
Maximum output wire resistance:	50 ohms
Maximum line capacitance:	0.22 microfarad

Ambient humidity limits:

5 to 100% relative humidity

Process pressure limits:

-14.7 psi (full vacuum) to flange rating

Materials of construction:

Process wetted parts:

Body:	CF8M (ANSI 316 stainless steel) or Hastelloy C (equivalent of ASTM494, CW12MW)
Shedder bar:	Duplex stainless steel (CD4MCU equivalent to ANSI 329 stainless steel) or Hastelloy C (equivalent of ASTM494, CW12MW)

Non-wetted parts:

Amplifier housing:	Aluminum alloy casting
Paint:	Case - Polyurethane resin baked coating, frosty white Cover - Polyurethane resin baked coating, deep, sea moss green

Analog Output :

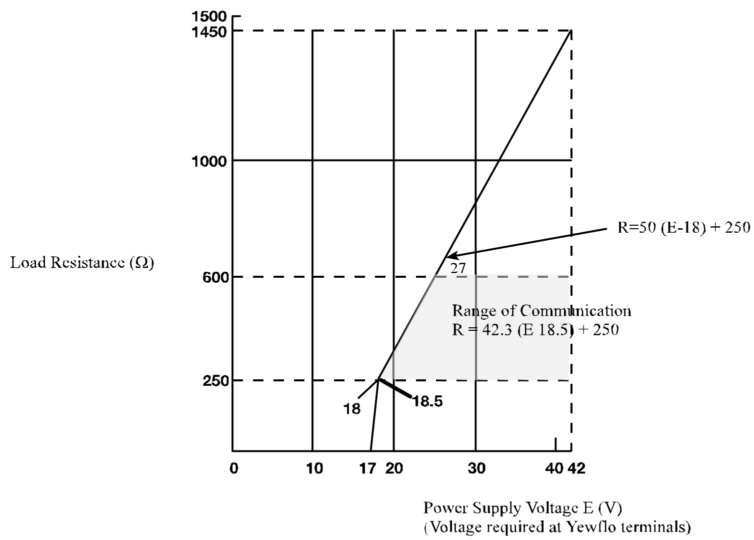


Figure 1.3.2: Relationship between power supply voltage and load resistance for analog output version

Pulse Output: Pulse output voltage = Vs-2v-Δv

where Δv = due to external load resistance

Vs = Power Supply Voltage

2v = 2 volts

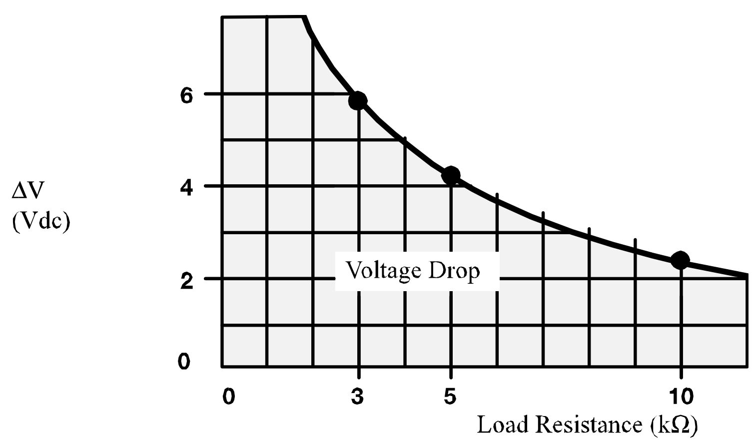


Figure 1.3.3: Load resistance vs. pulse output voltage drop

1.4 BASIC SIZING

1.4.1 Flowmeter sizing

Notes:
1) This table assumes standard conditions of 59ºF (15ºC).
2) Maximum flowrates are based on 32 ft/sec.
3) These figures are approximations. Refer to the Yewflo sizing program for the exact minimum and maximum for your application.
4) The values shown in parenthesis is the minimum linear flowrate.
5) Proper pipe bracing may be required to obtain minimum flowrate.

LIQUID

Nominal Size		Minimum and Maximum Measurable Flow Rates in U.S. gpm[1]			
mm	inch				
15	½	1.3	-4.2	and	27
25	1	2	-7.3	and	82
40	1½	5.9	-11.3	and	196
50	2	9.8	-14.5	and	324
80	3	20		and	628
100	4	33		and	1100
150	6	79		and	2400
200	8	150		and	4290
250	10	265		and	6460
300	12	300		and	9260

Table 1.4.1: Water -Flowmeter Range

GAS

Nominal Size (inches)	Flow Rate Limits	Minimum Linear and Maximum Measurable Air Flow Rates in SCFH (Standard conditions are 59°F and 14.7 psia) at process line pressure							
		0 psig	50 psig	100 psig	150 psig	200 psig	300 psig	400 psig	500 psig
½	min	172	361	500	719	939	1379	1822	2266
	max	1700	7492	13302	19128	24967	36692	48454	60266
1	min	400	839	1118	1486	1940	2851	3765	4683
	max	5267	23215	41217	59268	77362	113692	150137	186737
1½	min	792	1919	3037	4061	5026	6838	8970	11157
	max	1267	55397	98355	141428	184604	271296	358263	445599
2	min	1313	2756	4080	5867	7658	11254	14862	18485
	max	20821	91779	162951	234313	305846	449474	593557	738253
3	min	2534	5321	7877	11326	14784	21726	28691	35685
	max	40196	177182	314580	452347	590443	867720	1145876	1425214
4	min	4423	10710	16953	22670	28055	38174	50076	62283
	max	70157	309249	549061	789516	1030544	1514497	1999984	2487535
6	min	9685	29678	46977	64927	84749	124548	164473	204567
	max	153618	677145	1202247	1728757	2256524	3316208	4379250	5446812
8	min	20851	68121	107827	144185	178437	242799	303286	265774
	max	274675	1010761	2149664	3091086	4034753	5929510	7830269	9739113
10	min	37370	122437	193804	259153	320716	436397	545115	649056
	max	424752	1872295	3324193	4779987	6239253	9169263	12108556	15060351
12	min	53518	175343	277549	371134	459300	624968	780663	929518
	max	608291	2681328	4760604	6845457	8935284	13131375	17340759	21568047

Table 1.4.2: Air-Flowmeter Range

Notes:
1) Maximum flowrates are based on 262 ft/sec.
2) These figures are approximations. Refer to the sizing program for the exact minimum and maximum flowrates for your application.

STEAM

Nominal Size (inches)	Flow Rate Limits	Minimum Linear and Maximum Measurable Saturated Steam Flow Rates in lb/hr at process line pressure										
		15 psig	**25 psig**	**50 psig**	**75 psig**	**100 psig**	**125 psig**	**150 psig**	**175 psig**	**200 psig**	**250 psig**	**300 psig**
½	min	12.8	14.6	18.4	21.5	24.1	26.5	28.7	30.7	32.6	36.6	43.4
	max	122	161	254	346	437	527	616	705	765	973	1154
1	min	29.7	34	42.8	49.9	56.1	61.6	66.6	71.3	75.7	83.7	91.2
	max	379	498	788	1071	1353	1632	1910	2185	2464	3014	357
1½	min	58.7	67.3	84.6	98.6	118	137	156	173	191	224	257
	max	905	1188	1879	2554	3228	3894	4557	5215	5879	7192	8530
2	min	97.5	111	140	164	184	202	219	234	248	298	354
	max	1500	1969	3113	4232	5349	6452	7550	8639	9740	11916	14133
3	min	188	216	271	316	355	390	422	452	480	576	683
	max	2895	3800	6010	8170	10326	12455	14576	16678	18804	23004	27283
4	min	328	376	472	551	659	766	869	967	1065	1251	1434
	max	5054	6633	10490	14260	18023	21739	25440	29109	32820	40150	47620
6	min	719	824	1184	1515	1827	2122	2407	2681	2951	3467	3974
	max	11065	14523	22969	31224	39463	47600	55705	63739	71864	87914	104270
8	min	1549	1885	2720	3477	4193	4872	5525	6153	6773	7958	9122
	max	19785	25968	41070	55830	70561	85111	99603	113968	128496	157194	186439
10	min	2725	3387	4888	6249	7536	8756	9930	11060	12174	14304	16396
	max	30596	40157	63509	86334	109114	131614	154024	176238	198703	243081	288305
12	min	3903	4851	7000	8949	10793	12539	14220	15839	17434	20485	23481
	max	43816	57590	90952	123640	156263	188485	220578	252392	284564	348119	412883

Table 1.4.3: Steam - Flowmeter Range

Notes:
1) Maximum flowrates are based on 262 ft/sec.
2) These figures are approximations. Refer to the sizing program for the exact minimum and maximum flowrates for your applications.

Nominal Size (inches)	Internal Diameter (inches)	Cross Sectional Area (ft^2)	Nominal Pulse Rate (Hz/ft/s)	Nominal K-factor	
				Pulse/US gal	**Pulse/ft^3**
½	0.57	0.0018	19.1	1423	10645
1	1.01	0.0056	10.8	259	1940
1½	1.56	0.133	7.05	70.8	530
2	2.01	0.022	5.59	33.9	253
3	2.8	0.043	4.02	12.6	94.3
4	3.69	0.074	3	5.39	40.3
6	5.46	0.163	2.03	1.67	12.5
8	7.31	0.291	1.52	0.7	5.24
10	9.09	0.45	1.23	0.366	2.74
12	10.9	0.645	1.03	0.213	1.59

Table 1.4.4: Nominal K-factor and general flowmeter information

MODEL CODE	YEWFLO *E - STAINLESS WAFER
YF101	0.5" I.D. Stainless Steel Wafer
YF102	1.0" I.D. Stainless Steel Wafer
YF104	1.5" I.D. Stainless Steel Wafer
YF105	2.0" I.D. Stainless Steel Wafer
YF108	3.0" I.D. Stainless Steel Wafer
YF110	4.0" I.D. Stainless Steel Wafer
CERTIFICATION	
-AAU	Integral, 4-20 mA or pulse
-AAD	Integral, 4-20 mA for intrinsic safety
-AAR	Integral, pulse output for intrinsic safety
-NNN	Remote converter
PROCESS CONNECTIONS (wafer style for mounting between)	
B1	ANSI 150 lb Wafer Flanges
B2	ANSI 300 lb Wafer Flanges
B3	ANSI 600 lb Wafer Flanges
MATERIALS	
A-S3S3*E	Stainless Steel shedder bar & body
CERTIFICATION	
/FMF	FM explosionproof housing w/FM stamp
/FMS	FM intrinsic safety w/FM stamp
/CSF	CSA explosionproof housing w/CSA stamp
/CSS	CSA intrinsic safety w/CSA stamp
OPTIONS	
/HART	HART communications
/HPT	High temperature
/TBL	Local interface
/EPF	Epoxy-coated electronics housing
/OSW	Oxygen cleaning
/BLT	304 SS nuts and bolts
/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - STAINLESS 150# FLANGE
YF101	0.5" I.D. Stainless Steel 150 lb RF flange
YF102	1.0" I.D. Stainless Steel 150 lb RF flange
YF104	1.5" I.D. Stainless Steel 150 lb RF flange
YF105	2.0" I.D. Stainless Steel 150 lb RF flange
YF108	3.0" I.D. Stainless Steel 150 lb RF flange
YF110	4.0" I.D. Stainless Steel 150 lb RF flange
YF115	6.0" I.D. Stainless Steel 150 lb RF flange
YF120	8.0" I.D. Stainless Steel 150 lb RF flange
YF125	10.0" I.D. Stainless Steel 150 lb RF flange
YF130	12.0" I.D. Stainless Steel 150 lb RF flange

CONFIGURATION	
-AAU	Integral, 4-20 mA or pulse
-AAD	Integral, 4-20 mA for intrinsic safety
-AAR	Integral, pulse output for intrinsic safety
-NNN	Remote converter

PROCESS CONNECTIONS	
A1	ANSI 150 lb RF flanges

MATERIALS	
A-S3S3*E	Stainless Steel shedder bar & body

CERTIFICATION	
/FMF	FM explosionproof housing w/FM stamp
/FMS	FM intrinsic safety w/FM stamp
/CSF	CSA explosionproof housing w/CSA stamp
/CSS	CSA intrinsic safety w/CSA stamp

OPTIONS	
/HART	HART communications
/HPT	High temperature
/TBL	Local interface
/EPF	Epoxy-coated electronics housing
/OSW	Oxygen cleaning
/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - STAINLESS 300# FLANGE
YF101	0.5" I.D. Stainless Steel 300 lb RF flange
YF102	1.0" I.D. Stainless Steel 300 lb RF flange
YF104	1.5" I.D. Stainless Steel 300 lb RF flange
YF105	2.0" I.D. Stainless Steel 300 lb RF flange
YF108	3.0" I.D. Stainless Steel 300 lb RF flange
YF110	4.0" I.D. Stainless Steel 300 lb RF flange
YF115	6.0" I.D. Stainless Steel 300 lb RF flange
YF120	8.0" I.D. Stainless Steel 300 lb RF flange
YF125	10.0" I.D. Stainless Steel 300 lb RF flange
YF130	12.0" I.D. Stainless Steel 300 lb RF flange

CONFIGURATION	
-AAU	Integral, 4-20 mA or pulse
-AAD	Integral, 4-20 mA for intrinsic safety
-AAR	Integral, pulse output for intrinsic safety
-NNN	Remote converter

PROCESS CONNECTIONS	
A2	ANSI 300 lb RF flanges

MATERIALS	
A-S3S3*E	Stainless Steel shedder bar & body

CERTIFICATION	
/FMF	FM explosionproof housing w/FM stamp
/FMS	FM intrinsic safety w/FM stamp
/CSF	CSA explosionproof housing w/CSA stamp
/CSS	CSA intrinsic safety w/CSA stamp

OPTIONS	
/HART	HART communications
/HPT	High temperature
/TBL	Local interface
/EPF	Epoxy-coated electronics housing
/OSW	Oxygen cleaning
/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - STAINLESS 600# FLANGE
YF101	0.5" I.D. Stainless Steel 600 lb RF flange
YF102	1.0" I.D. Stainless Steel 600 lb RF flange
YF104	1.5" I.D. Stainless Steel 600 lb RF flange
YF105	2.0" I.D. Stainless Steel 600 lb RF flange
YF108	3.0" I.D. Stainless Steel 600 lb RF flange
YF110	4.0" I.D. Stainless Steel 600 lb RF flange
YF115	6.0" I.D. Stainless Steel 600 lb RF flange
YF120	8.0" I.D. Stainless Steel 600 lb RF flange

CONFIGURATION	
-AAU	Integral, 4-20 mA or pulse
-AAD	Integral, 4-20 mA for intrinsic safety
-AAR	Integral, pulse output for intrinsic safety
-NNN	Remote converter

PROCESS CONNECTIONS	
A3	ANSI 600 lb RF flanges

MATERIALS	
A-S3S3*E	Stainless Steel shedder bar & body

CERTIFICATION	
/FMF	FM explosionproof housing w/FM stamp
/FMS	FM intrinsic safety w/FM stamp
/CSF	CSA explosionproof housing w/CSA stamp
/CSS	CSA intrinsic safety w/CSA stamp

OPTIONS	
/HART	HART communications
/HPT	High temperature
/TBL	Local interface
/EPF	Epoxy-coated electronics housing
/OSW	Oxygen cleaning
/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - HASTELLOY C WAFER					
YF101	0.5" I.D. Hastelloy C Wafer					
YF102	1.0" I.D. Hastelloy C Wafer					
YF104	1.5" I.D. Hastelloy C Wafer					
YF105	2.0" I.D. Hastelloy C Wafer					
YF108	3.0" I.D. Hastelloy C Wafer					
YF110	4.0" I.D. Hastelloy C Wafer					
	CERTIFICATION					
	-AAU	Integral, 4-20 mA or pulse				
	-AAD	Integral, 4-20 mA for intrinsic safety				
	-AAR	Integral, pulse output for intrinsic safety				
	-NNN	Remote converter				
		PROCESS CONNECTIONS (wafer style for mounting between)				
		B1	ANSI 150 lb RF flanges			
		B2	ANSI 300 lb RF flanges			
		B3	ANSI 600 lb RF flanges			
			MATERIALS			
			A-HCHC*E	Hastelloy C Shedder wetted parts		
				CERTIFICATION		
				/FMF	FM explosionproof housing w/FM stamp	
				/FMS	FM intrinsic safety w/FM stamp	
				/CSF	CSA explosionproof housing w/CSA stamp	
				/CSS	CSA intrinsic safety w/CSA stamp	
					OPTIONS	
					/HART	HART communications
					/TBL	Local interface
					/EPF	Epoxy-coated electronics housing
					/OSW	Oxygen cleaning
					/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - HASTELLOY C 150# FLANGE					
YF101	0.5" I.D. Hastelloy C 150 lb RF flange					
YF102	1.0" I.D. Hastelloy C 150 lb RF flange					
YF104	1.5" I.D. Hastelloy C 150 lb RF flange					
YF105	2.0" I.D. Hastelloy C 150 lb RF flange					
YF108	3.0" I.D. Hastelloy C 150 lb RF flange					
YF110	4.0" I.D. Hastelloy C 150 lb RF flange					
YF115	6.0" I.D. Hastelloy C 150 lb RF flange					
	CERTIFICATION					
	-AAU	Integral, 4-20 mA or pulse				
	-AAD	Integral, 4-20 mA for intrinsic safety				
	-AAR	Integral, pulse output for intrinsic safety				
	-NNN	Remote converter				
		PROCESS CONNECTIONS (wafer style for mounting between)				
		A1	ANSI 150 lb RF flanges			
			MATERIALS			
			A-HCHC*E	Hastelloy C Shedder wetted parts		
				CERTIFICATION		
				/FMF	FM explosionproof housing w/FM stamp	
				/FMS	FM intrinsic safety w/FM stamp	
				/CSF	CSA explosionproof housing w/CSA stamp	
				/CSS	CSA intrinsic safety w/CSA stamp	
					OPTIONS	
					/HART	HART communications
					/TBL	Local interface
					/EPF	Epoxy-coated electronics housing
					/OSW	Oxygen cleaning
					/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - HASTELLOY C 300# FLANGE
YF101	0.5" I.D. Hastelloy C 300 lb RF flange
YF102	1.0" I.D. Hastelloy C 300 lb RF flange
YF104	1.5" I.D. Hastelloy C 300 lb RF flange
YF105	2.0" I.D. Hastelloy C 300 lb RF flange
YF108	3.0" I.D. Hastelloy C 300 lb RF flange
YF110	4.0" I.D. Hastelloy C 300 lb RF flange
YF115	6.0" I.D. Hastelloy C 300 lb RF flange

CERTIFICATION	
-AAU	Integral, 4-20 mA or pulse
-AAD	Integral, 4-20 mA for intrinsic safety
-AAR	Integral, pulse output for intrinsic safety
-NNN	Remote converter

PROCESS CONNECTIONS (wafer style for mounting between)	
A2	ANSI 300 lb RF flanges

MATERIALS	
A-HCHC*E	Hastelloy C wetted parts

CERTIFICATION	
/FMF	FM explosionproof housing w/FM stamp
/FMS	FM intrinsic safety w/FM stamp
/CSF	CSA explosionproof housing w/CSA stamp
/CSS	CSA intrinsic safety w/CSA stamp

OPTIONS	
/HART	HART communications
/TBL	Local interface
/EPF	Epoxy-coated electronics housing
/OSW	Oxygen cleaning
/SCT	Stainless Steel tags wired into place

YEWFLO *E - NACE MATERIALS WAFER

MODEL CODE	METER SIZES
YF101	0.5" I.D. NACE Wafer
YF102	1.0" I.D. NACE Wafer
YF104	1.5" I.D. NACE Wafer
YF105	2.0" I.D. NACE Wafer
YF108	3.0" I.D. NACE Wafer

	CERTIFICATION
-AAU	Integral, 4-20 mA or pulse
-AAD	Integral, 4-20 mA for intrinsic safety
-AAR	Integral, pulse output for intrinsic safety
-NNN	Remote converter

	PROCESS CONNECTIONS (wafer style for mounting between)
B1	ANSI 150 lb RF flanges
B2	ANSI 300 lb RF flanges
B3	ANSI 600 lb RF flanges

	MATERIALS
A-HCS3*E	Hastelloy C shedder bar w/stainless steel body

	CERTIFICATION
/FMF	FM explosionproof housing w/FM stamp
/FMS	FM intrinsic safety w/FM stamp
/CSF	CSA explosionproof housing w/CSA stamp
/CSS	CSA intrinsic safety w/CSA stamp

	OPTIONS
/HART	HART communications
/TBL	Local interface
/EPF	Epoxy-coated electronics housing
/OSW	Oxygen cleaning
/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - NACE MATERIALS 150# FLANGE
YF101	0.5" I.D. NACE 150 lb RF Flange
YF102	1.0" I.D. NACE 150 lb RF Flange
YF104	1.5" I.D. NACE 150 lb RF Flange
YF105	2.0" I.D. NACE 150 lb RF Flange
YF108	3.0" I.D. NACE 150 lb RF Flange

CERTIFICATION	
-AAU	Integral, 4-20 mA or pulse
-AAD	Integral, 4-20 mA for intrinsic safety
-AAR	Integral, pulse output for intrinsic safety
-NNN	Remote converter

PROCESS CONNECTIONS	
A1	ANSI 150 lb RF flanges

MATERIALS	
A-HCS3*E	Hastelloy C shedder bar w/stainless steel body

CERTIFICATION	
/FMF	FM explosionproof housing w/FM stamp
/FMS	FM intrinsic safety w/FM stamp
/CSF	CSA explosionproof housing w/CSA stamp
/CSS	CSA intrinsic safety w/CSA stamp

OPTIONS	
/HART	HART communications
/TBL	Local interface
/EPF	Epoxy-coated electronics housing
/OSW	Oxygen cleaning
/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - NACE MATERIALS 300# FLANGE
YF101	0.5" I.D. NACE 300 lb RF Flange
YF102	1.0" I.D. NACE 300 lb RF Flange
YF104	1.5" I.D. NACE 300 lb RF Flange
YF105	2.0" I.D. NACE 300 lb RF Flange
YF108	3.0" I.D. NACE 300 lb RF Flange
	CERTIFICATION
-AAU	Integral, 4-20 mA or pulse
-AAD	Integral, 4-20 mA for intrinsic safety
-AAR	Integral, pulse output for intrinsic safety
-NNN	Remote converter
	PROCESS CONNECTIONS
A2	ANSI 300 lb RF flanges
	MATERIALS
A-HCS3*E	Hastelloy C shedder bar w/stainless steel body
	CERTIFICATION
/FMF	FM explosionproof housing w/FM stamp
/FMS	FM intrinsic safety w/FM stamp
/CSF	CSA explosionproof housing w/CSA stamp
/CSS	CSA intrinsic safety w/CSA stamp
	OPTIONS
/HART	HART communications
/TBL	Local interface
/EPF	Epoxy-coated electronics housing
/OSW	Oxygen cleaning
/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - NACE MATERIALS 600# FLANGE
YF101	0.5" I.D. NACE 600 lb RF Flange
YF102	1.0" I.D. NACE 600 lb RF Flange
YF104	1.5" I.D. NACE 600 lb RF Flange
YF105	2.0" I.D. NACE 600 lb RF Flange
YF108	3.0" I.D. NACE 600 lb RF Flange

CERTIFICATION	
-AAU	Integral, 4-20 mA or pulse
-AAD	Integral, 4-20 mA for intrinsic safety
-AAR	Integral, pulse output for intrinsic safety
-NNN	Remote converter

PROCESS CONNECTIONS	
A3	ANSI 600 lb RF flanges

MATERIALS	
A-HCS3*E	Hastelloy C shedder bar w/stainless steel body

CERTIFICATION	
/FMF	FM explosionproof housing w/FM stamp
/FMS	FM intrinsic safety w/FM stamp
/CSF	CSA explosionproof housing w/CSA stamp
/CSS	CSA intrinsic safety w/CSA stamp

OPTIONS	
/HART	HART communications
/TBL	Local interface
/EPF	Epoxy-coated electronics housing
/OSW	Oxygen cleaning
/SCT	Stainless Steel tags wired into place

MODEL CODE	YEWFLO *E - REMOTE CONVERTER				
YFA11	Remote Converter				
	CONFIGURATION				
	-AUPA	4-20 mA or pulse output			
	-ADPA	4-20 mA for intrinsic safety			
	-ARPA	Pulse output for intrinsic safety			
		METER SIZES			
		-01*E	0.5" body		
		-02*E	1.0" body		
		-04*E	1.5" body		
		-05*E	2.0" body		
		-08*E	3.0" body		
		-10*E	4.0" body		
		-15*E	6.0" body		
		-20*E	8.0" body		
		-25*E	10.0" body		
		-30*E	12.0" body		
			CERTIFICATION		
			/FMF	FM explosionproof housing w/FM stamp	
			/FMS	FM intrinsic safety w/FM stamp	
			/CSF	CSA explosionproof housing w/CSA stamp	
			/CSS	CSA intrinsic safety w/CSA stamp	
				OPTIONS	
				/HART	HART communications
				/TBL	Local interface
				/EPF	Epoxy-coated electronics housing
				/SCT	Stainless Steel tags wired into place
				/Z	Additional cable, per foot

CABLE TYPE, *E					
YF011	Remote meter interconnecting cable				
	CONFIGURATION				
	-1	Terminated ends			
		METER SIZES			
		-0010F	10 feet		
		-0015F	15 feet		
		-0030F	30 feet		
		-0050F	50 feet		
		-0065F	65 feet		
			CERTIFICATION		
			*E	Style E	

II. QUICK START

BT100/BT200 HANDHELD TERMINAL

Note: If you specified the correct process conditions on your order, these parameters have been preset at the factory; therefore, there is no need to re-enter the data.

The Style E YEWFLO is a smart communicating device with microprocessor-based technology. When used with Yokogawa's BT100 or BT200 handheld terminal (HHT), YEWFLO can be configured to meet specific application needs. In addition, the optional local indicator/totalizer (TBL option) allows setting of various parameters.

When in the analog output mode, the HHT may be connected at any point on the instrument's 4-20 mA loop. This connection superimposes a digital signal on top of the instrument's 4-20 mA signal making communications completely transparent to your process signal. On the other hand, since there are no 4-20 mA wires in the pulse mode, direct connection of the HHT to the HHT PULSE and HHT COM test points on the amplifier is necessary. Once connected, flowrate and total can be read, tag numbers entered, meter size or any other parameter modified as required. Additionally, you may activate or deactivate many features of the YEWFLO as necessary to meet the requirements of your application.

The HHT will enable you to scroll through the program until you locate the parameter that you wish to change. For communication information, see "How to communicate with the YEWFLO remotely" in the maintenance section. Please refer to the appropriate HHT instruction manual for details on each HHT.

To change a parameter using the BT100, insert the removable key in the lock and turn it clockwise to the ENABLE position. If the key is not in place or if it is in the INHIBIT position, you will receive an OPERATION ERR message on the display when you press either the **INC** or **DEC** key or try to enter an alphanumeric value in any parameter. If this occurs, insert the key in the lock, turn it clockwise to the ENABLE position then press either the **INC**, **DEC** or alphanumeric key as before.

2.1 PARAMETER SETTING IN BRAIN™ COMMUNICATIONS

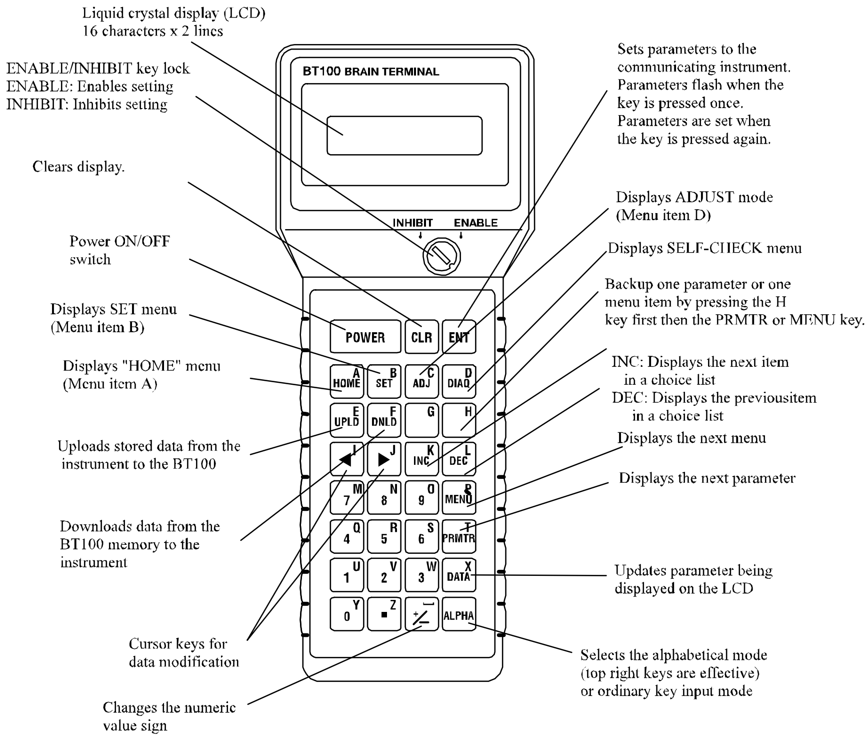
The Model YF100*E Vortex flowmeter incorporates BRAIN™ communication functions. These functions enable the Vortex converter to remotely carry out the following functions by communicating with the BRAIN™ Terminal (BT100 or BT200), µXL, or Centum-XL distributed control systems.

- Setting or changing parameters required for vortex meter operation such as tag number, flow span and process conditions for example.
- Monitoring flowrate, totalized flow and self-diagnostics.
- 4-20 mA loop check (simulated output) and totalizer reset.

Note: When the pulse/analog jumpers are set for a pulse output, **Remote** BRAIN™ communication on the 4-20 mA wires is not available. Therefore parameters cannot be set or read remotely. For the BT100 to operate in the pulse output mode, the instrument must be connected to the test points labeled **HHT Pulse** and **HHT Com.** This allows access to all parameters.

Note: Only the position of the jumpers affects remote communication ability, the software setting of pulse or 4-20 mA has no effect.

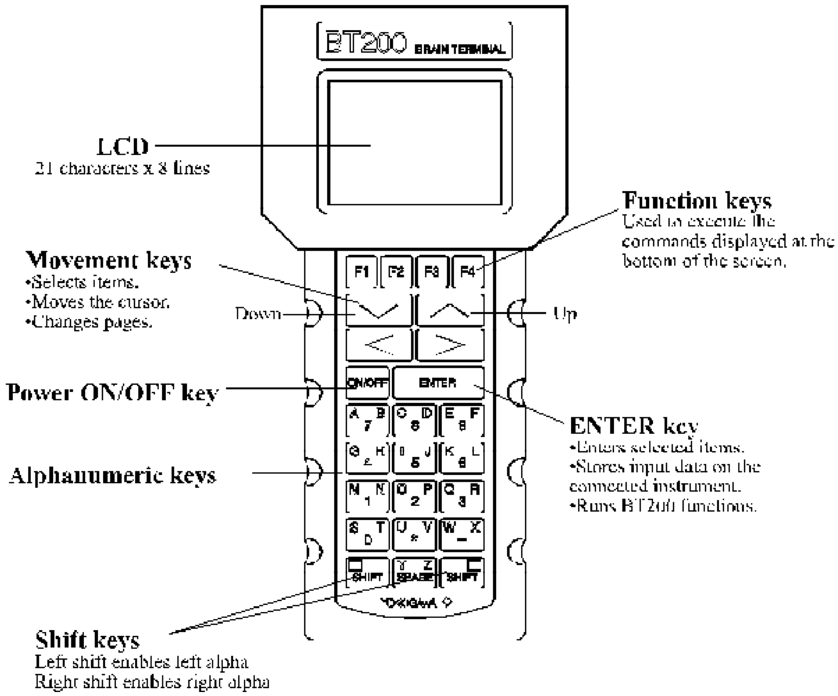
BT100 Basic Operation



1) POWER on.
2) First three key strokes will always display "Model No.", Tag No.", and "Self-check".
3) Press **MENU** key to select desired main menu.
4) Press **PMTR** key to move down through the selected menu.
5) Once a parameter has been selected, use the **INC** or **DEC** keys to review options within the parameter list. When data input is required, use the alpha key to toggle between the alpha and numeric characters (A to Z, 0 to 9).
6) Once a parameter has been selected, push **ENT** twice to save the changes.

Notes:
A) Use the **ALPHA** key to move between alpha and numeric characters.
B) To back up in the programming sequence, push **H** key and then **PMTR** when in parameter mode or **MENU** when in main menu mode.
C) **UPLD** and **DNLD** keys permit copying settings from one instrument in BT100 non-volatile memory to another instrument.
D) The automatic power-off of the BT100 automatically turns off the power when no key has been pressed for about 5 minutes. This function is not active during the display A10: Flowrate %, A20: Flowrate, or A30: Total. The display of these values is updated every 5 seconds.

BT200 Basic Operation



1) Press ON/OFF to activate power.
2) Press **ENTER** key when prompted.
3) "Model", "Tag No.", and "Self-check" will always be displayed next.
4) Press **F4** to continue. The main menu list will be displayed next.
5) Highlight the desired menu by using the up and down movement keys. Press **ENTER** to access the selected menu.
6) Use the up and down movement keys to highlight the desired parameter and press **ENTER** to access.
7) Once a parameter has been selected either:
   a) Use the up and down movement keys to review options within the parameter. Once the appropriate option has been selected, press **ENTER** twice to edit the selection.
   b) Where data input is required, use the alpha key to toggle between the alpha and numeric characters. Press **ENTER** twice to save the changes.

Notes:
A) The function keys (**F1-F4**) are used to execute the commands displayed at the bottom of the screen.
B) Use the left (<) and right (>) movement keys to change whole page of displayed information. The "<" key shows the preceding page and the ">" key the following page.
C) To select a desired alpha character, always use the appropriate **SHIFT** key. Use the green shift key to select letters marked in green and the black shift key to select letters marked in black. If the alpha/numeric keys are not used in conjunction with the **SHIFT** key, the numeric value shown on the key will be displayed.
D) To go directly to a particular parameter anywhere in the menu tree while working in a menu, press either **SHIFT** key and then press **F4**. Type the parameter designation (example B24) to be displayed and press **ENTER**.

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2.2 YEWFLO SETUP

Note: If you specified the correct process conditions on your order, these parameters have been preset at the factory; therefore, there is no need to re-enter the data.

The purpose of a Quick Start is to address only those parameters which must be set to establish the operation of a meter for this application. Follow the parameters listed below and enter the data for your particular application.

With the BT100 or BT200 properly connected to the Vortex meter begin communicating by pressing the power button. After the power up sequence is complete, go to " Menu B: SET 1". The operation of the BT100 and BT200 are slightly different. Please refer to the 'Basic Handheld Terminal Operation' if you are unfamiliar with how to move through the menus and parameters. The following flow chart identifies only the parameters to be set, you may have to skip several parameters or menus to get to the parameters shown below. **Be sure to enter all values and selections shown below or they will not be saved. If you make a typing error, use the** CLR **key to clear and re-enter.**

2.3 Parameter Setting in HART™ Communications

When specified, the model YF100*E vortex flowmeter can be provided with HART™ communication functions. (To determine if this field communication protocol has been incorporated in your instrument, confirm the "HART" suffix is a part of the YEWFLO model code.) These functions enable the vortex converter to remotely carry out the following by communicating with the HART communicator:

- Setting or changing parameters required for vortex meter operation such as tag number, flow span and process conditions.
- Monitoring flowrate, totalized flow and self-diagnostics.
- 4-20 mA loop check (simulated output) and totalizer rest

The HART communicator can interface with YEWFLO from the control room, via direct connection to the amplifier, or any other wiring termination point on the 4-20 mA loop. Polarity does not matter. There must be a minimum of 250 ohms between the connection and the power supply. Refer to Figure 1.3.2 on page 7 for power supply voltage requirements and load resistance.

Note1: The output jumpers on the amplifier must be set to the analog position to communicate. Only the position of the jumpers affects remote communication ability, the software setting of pulse or 4-20 mA has no effect.

Note2: When Yewflo is supplied with the HART option, the TBL digital display/local operator interface cannot be used for parameter setting and configuration. Only two parameters are supported by the TBL:

Parameter E01: Total reset
Parameter E02: Display Select

The amplifier has been pre-configured at the factory, so no setup should be required prior to installation. If your process conditions have changed and reprogramming is required, the menu/ parameter configuration list for YEWFLO/HART can be found in Appendix B in the back of this manual. Refer to the instructions provided with your HART communicator or operation details. The QUICK START section of this manual will address only those parameters which must be set to establish the operation of the meter for a particular application. Appendix B will cross-reference the BRAIN parameters to the corresponding HART parameters.

2.3.1 Communication Specifications

Method of communication: Frequency shift keying (FSK). Conforms with Bell 202 Modem standard with respect to baud rate and digital "1" and "0" frequencies.

Baud Rate:	1,200 bps
Digital "0" Frequency:	2,200 Hz
Digital "1" Frequency:	1,200 Hz
Data Byte Structure:	1 start bit, 8 data bits, 1 odd parity bit, 1 stop bit

Single Digital Process Variable Rate:

Poll/Response Mode:	2.0 per second
Burst Mode:	3.7 per second

Maximum Number of Multi-drop Devices:

Loop Powered:	15

Multivariable Specification:

Maximum process variable per smart device:	256

Maximum Number of Communication Masters:	Two

2.3.2 Hardware Recommendations:

Supply Voltage:	17-42 VDC
Load Resistance:	250 to 600 ohms (includes cable resistance) Refer to Figure 1.3.2 on page 7 for power supply voltage requirements and load resistance.
Minimum cable size:	24 AWG, (0.51 mm diameter)
Cable Type:	Single pair shielded or multiple pair with overall shield
Maximum Twisted-Pair Length:	10,000 ft. (3,048 m)
Maximum Multiple Twisted-Pair Length:	5,000 ft (1,524 m)

Use the following formula to determine cable length for a specific application:

$$L = \frac{65 \times 106}{(R \times C)} - \frac{(Cr + 10,000)}{C}$$

where:

L = length in feet or meters
R = resistance in ohms (current sense resistance plus barrier resistance)
C = cable capacitance in pF/ft or pF/m
Cf = maximum shunt capacitance of field device in pF

III. INSTALLATION

Before installing your YEWFLO you will need to gather the following tools:

Wafer Style:
1. Gaskets - self-centering preferred. In no case should the I.D. of the gaskets be smaller than the I.D. of the meter.
2. Wrenches - Two of a size appropriate for the nuts supplied.
3. Screw driver - A small Phillips or flat blade type may be used to connect lead wires.
4. Sufficient wire to reach from the meter signal converter to the power source, receiving device. See the Wiring Section of this manual for wire recommendations.
5. Stud bolts, washers and nuts are supplied with the meter

Flanged Style:
1. Nuts, bolts and washers appropriate in type, size, material and quantity for the flange as specified by ANSI standards.
2. Gaskets - self-centering preferred. In no case should the I.D. of the gaskets be smaller than the I.D. of the meter.
3. Wrenches - Two of a size appropriate for the nuts supplied.
4. Screw driver - A small Phillips or flat blade type may be used to connect lead wires.
5. Sufficient wire to reach from the meter signal converter to the power source, receiving device. See the Wiring Section of this manual for wire recommendations.

3.1 PIPING REQUIREMENTS

To obtain maximum performance, the vortex flowmeter should be installed in a pipe with a straight run the same size as the nominal size of the meter. On the upstream side, the straight run depends on what is in the pipe ahead of the meter. In most installations a maximum of 20 diameters will be sufficient. The pipe on the downstream side of the meter should always be at least 5 diameters. The combination of flowmeter with upstream and downstream pipe is referred to as the metering run. Refer to the following illustrations for the minimum straight pipe for your installation. Note that in all installations the mating pipe on either side of the vortex meter must match the meter size. In many applications proper sizing may recommend using one meter size smaller than the existing pipe. When this is the case, concentric reducers should not be directly attached to the flowmeter, but installed on either end of the metering run as shown. In any case, the guidelines for orifice plate installations as published by the ASME will be safe to follow.

IDEAL

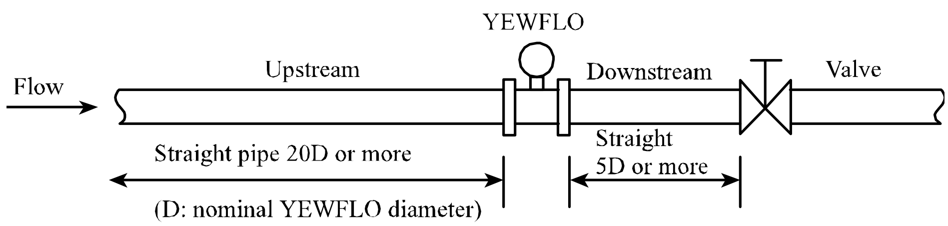

Figure 3.1.1: YEWFLO upstream side of valve

ACCEPTABLE

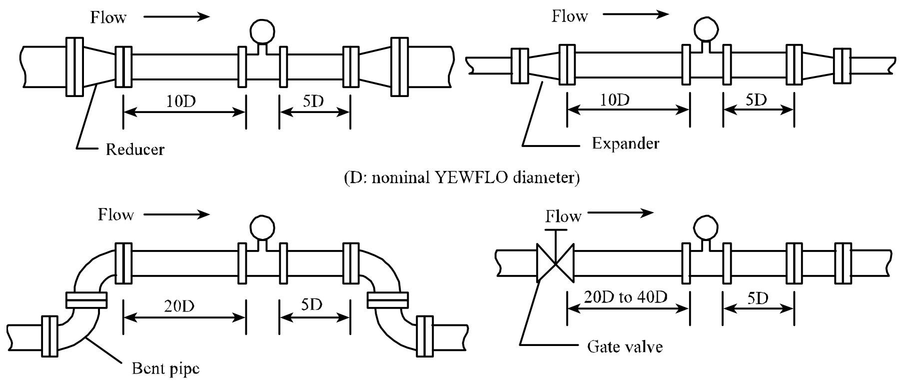

Figure 3.1.2: Reducer, expander, elbow and valve

If the meter cannot be located in the piping where the minimum straight run requirements can be met, it may be possible to install flow conditioning equipment upstream of the vortex meter and reduce the upstream piping without significantly reducing the accuracy. Contact your local representative or Yokogawa Industrial Automation for recommendations regarding flow conditioners.

3.1.1 Pipe schedule

We recommend pipe schedule 40 for ½" through 2" meter sizes. For meters larger than 2", use schedule 80 pipe or smaller. If pipe schedule other than above is used, please refer to Parameter D05 to correct errors due to mismatched pipe schedule.

3.1.2 Flow direction and orientation

Before installing the vortex meter **verify the arrow on the meter body is facing the same direction as the direction of the flow.** The direction of flow can be determined by the arrow on the shedder bar or clamping plate. The meter may be installed with the converter located above, below or to the side of the piping, whatever suits the selected installation location best. Flow may be horizontal or vertical, as long as the pipe is completely full. For liquid applications vertical flow up is preferred, as this guarantees a full pipe at all times.

3.1.3 Pressure and temperature taps

If you are metering a gas where pressure and temperature compensation is required, pressure and temperature taps must be located downstream of the vortex meter. See Figure 3.1.3.

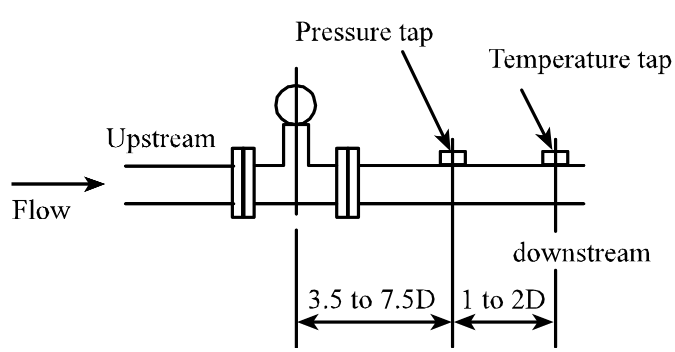

Figure 3.1.3: Pressure and Temperature taps

3.1.4 Flushing the pipe

On a new installation we recommend flushing the pipeline and removing any and all scales on the inside of the pipe before installing the vortex meter. The bypass piping should be installed around the vortex meter to facilitate pipe cleaning. When there is no bypass piping, the vortex meter should be temporarily removed and a spool piece installed in its place.

3.1.5 Gaskets

The ID of the gaskets must be equal to or larger than the ID of the meter and mating pipe. The gaskets should be the self-centering type. It is important that the gaskets not protrude into the flow stream, otherwise accuracy will be adversely affected.

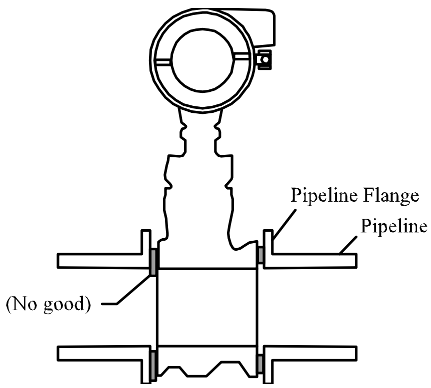

Figure 3.1.4: Gasket cross section

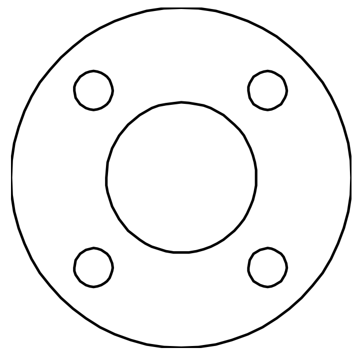

Figure 3.1.5: Typical gasket with bolt holes

3.2 Installing the Vortex Meter

Before installing the vortex meter, verify the arrow on the meter body is facing the same direction as the direction of the flow.

3.2.1 Installing the wafer style vortex meter

When installing the wafer type vortex meter it is important to align the instrument bore with the inner diameter of the adjacent piping. For meters in sizes ½" through 3", four alignment collars are supplied. These collars establish a predetermined spacing between the mounting bolts and the outside diameter of the vortex meter body. The bolts must be of the proper diameter to establish alignment. Carbon steel stud bolts and nuts are supplied as standard. Stainless steel (304) stud bolts and nuts are optional. Gaskets are supplied by the user. Check all mating flanges ensuring all weld slag is ground off and the inside surface is clean and smooth.

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Meter Size	Flange Rating	Collar Kit (4 per set)	Mark on collar
0.5"	150#	F9322GC	GL
0.5"	300#, 600#	F9322GD	GM
1.0"	150#	F9322HC	HL
1.0"	300#, 600#	F9322GA	GJ
1.5"	150#	F9322GC	GL
1.5"	300#, 600#	F9322JD	JM
2.0"	150#	F9322KA	KC
3.0"	150#	F9322KM	KP

Table 3.2.1: Dimensions

Note: Only the above indicated meter sizes require collars

3.2.2 Installing the wafer style vortex meter horizontally

1) Insert two collars (see dimensions table above) on each of the two lower bolts.
2) Place the vortex meter on the collars located on the lower two bolts making sure the arrow on the side of the meter body is facing in the same direction as the flow.
3) Insert the remaining bolts and tighten all bolts and nuts uniformly.
4) Check for leakage between the meter body and the flanges.

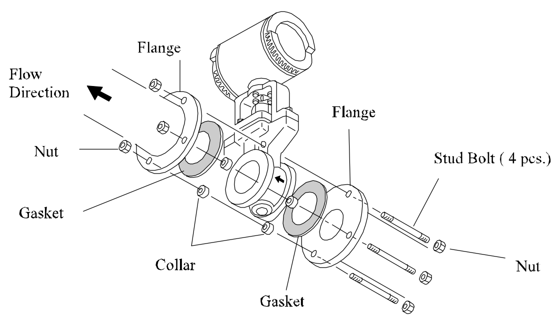
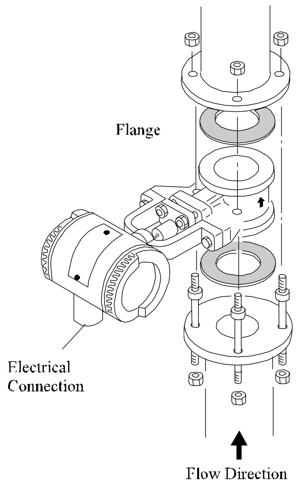


Figure 3.2.1: Wafer type - horizontal installation

3.2.3 Installing the wafer style vortex meter vertically

1) Insert one collar (if required, see table 3.2.1) on each bolt, being certain that the collars are in contact with the outside diameter of the vortex meter body. Make sure the arrow on the side of the meter body is facing the same direction as the flow.
2) Tighten all bolts uniformly.
3) Check for leakage between the meter body and the flanges.



CAUTION:
When installing the vortex meter in a vertical pipe outdoors we recommend rotating the conduit connection to face downward reducing the chance of rain and condensate running down the conduit into the housing.

Fig 3.2.2: Wafer type - vertical installation

3.2.4 Installing the flanged vortex meter

Use bolts, nuts and gaskets in accordance with ANSI B16.5 (user supplied). The ID of the gasket must be equal to or greater than the ID of the meter bore. Self-centering gaskets are highly recommended.

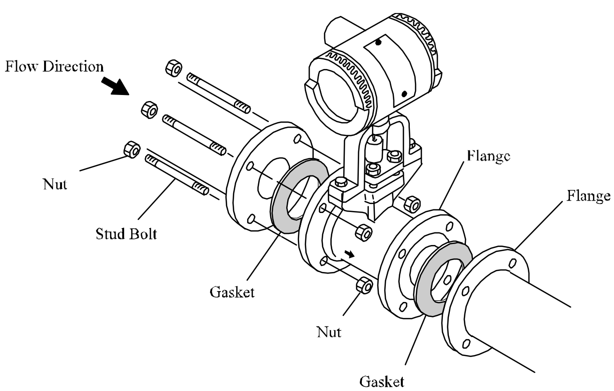


Figure 3.2.3: Flanged type - horizontal installation

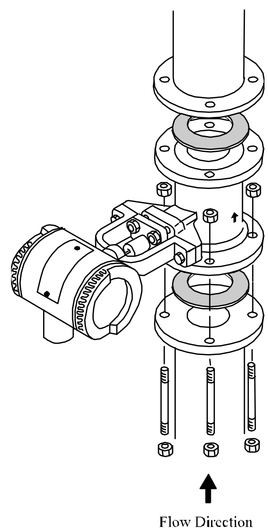


Figure 3.2.4: Flanged type - vertical installation

3.2.5 Insulating vortex meters with integral converter

When installing a vortex meter with an integral converter in a pipe to measure high temperature fluids, do not insulate the converter housing or mounting bracket. If it is necessary to insulate the entire installation, use a remote mounted converter. Custom steam jackets are available if necessary, please contact your Yokogawa Industrial Automation Representative for more information.

3.2.6 Rotating the meter housing

The terminal box or converter housing may be rotated in 90º increments with respect to the pipe for viewing or wiring convenience.

3.2.7 Remote converter terminal box rotation

1) Turn the power off.
2) Remove the terminal box cover.
3) Disconnect the lead wires from the sensor, Red (A) and White (B).
4) For 1" through 4" meter sizes, remove the bracket mounting bolts and the terminal box from the meter body. Remove the four Allen bolts securing the terminal box to the bracket, rotate to the desired position and reassemble.
5) On larger meters remove the 4 hex bolts securing the terminal box, rotate to the desired position and reassemble.

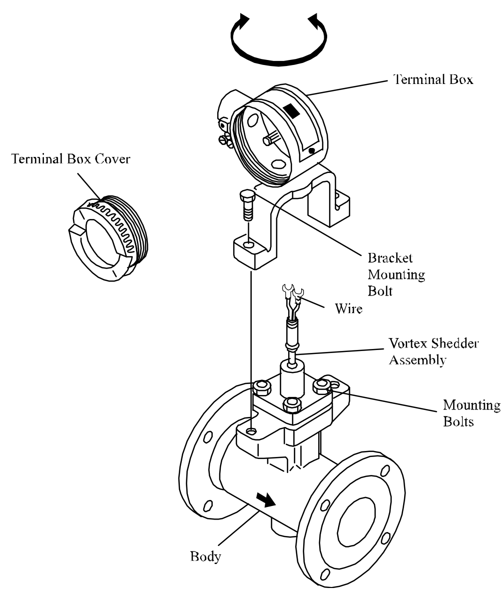


Figure 3.2.5: Changing the terminal box orientation

3.2.8 Integral converter rotation

1) Turn the power off.
2) Remove the converter cover.
3) Remove the amplifier.
4) Disconnect the wires from the sensor, Red (A) and White (B).
5) For 1" through 4" meter sizes, remove the bracket mounting bolts and the amplifier housing from the meter body. Remove the four Allen bolts securing the housing to the bracket, rotate to the desired position and reassemble.
6) On larger meters remove the 4 hex bolts securing the amplifier housing, rotate to the desired position and reassemble.

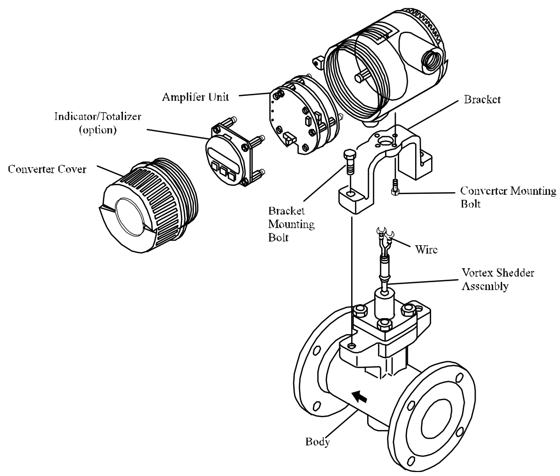


Figure 3.2.6: Changing the converter orientation

3.2.9 Installing the remote converter

A special signal cable (YF011) **must** be used between the vortex meter body and the remote electronics. The maximum cable length is 65 feet (20 meters). **Do not splice additional cable to extend the length.** The converter may mounted on 2" nominal pipe stand (horizontal or vertical) using the supplied mounting bracket. The converter orientation may be rotated in 90º increments if necessary to simplify wiring or viewing. To shorten the cable in the field please refer to the section on cable.

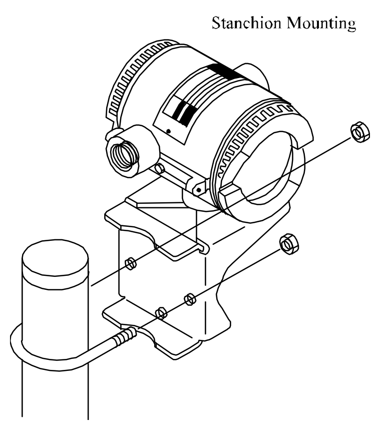


Figure 3.2.7: Converter installation
vertical pipe mounting

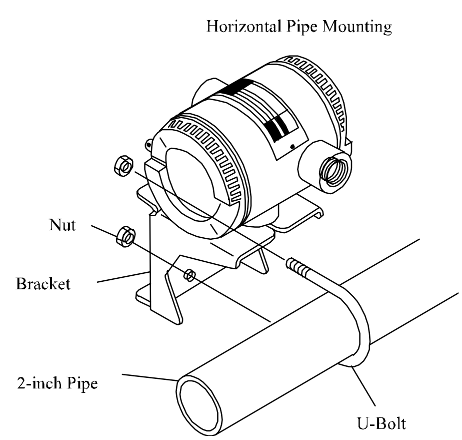


Figure 3.2.8: Converter installation
horizontal pipe mounting

Note: If there is a local indicator (option /TBL) included on the remote amplifier, its display may be rotated in 90º increments to facilitate reading the display.

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3.3 WIRING

3.3.1 Cables and wires (analog or pulse output wires only)

The following recommendations should be considered when selecting output wire for YEWFLO, and installing it in the field.

1) Use 600 V PVC insulated wire or equivalent.
2) Use shielded wire in areas susceptible to electrical noise.
3) Use wire and cable suitable for the ambient environment, especially temperature and chemical compatibility.
4) Lay wires as far as possible from electrical noise sources such as large transformers, motors, and power supplies.
5) When wiring in a vertical position, a drip loop with a drain should be installed in the conduit so that water does not run down the wire and into the converter housing.
6) We recommend using crimp-on solderless type lugs for the output wire termination.
7) For industrial installations, we recommend using conduit or cable tray to protect wiring from water or mechanical damage. A rigid steel conduit or flexible metal conduit is acceptable.
8) Safety grounding should meet National Electrical Code Class 3 requirements (resistance to ground of 100 ohms or less). Ground wires should be 600 V PVC insulated wire.

3.3.2 Analog output, 2-wire type (4-20 mADC)

When configured for analog output, the two instrument output wires also provide power. A DC power supply (user supplied) is required in the loop. The power supply voltage required is determined by the total instrument loop resistance including output wires. The permissible resistance versus required power supply voltage is shown in figures 3.3.1 and 3.3.2.

Note: The field chassis ground and minus (-) power supply terminal are isolated from each other and should not be connected.

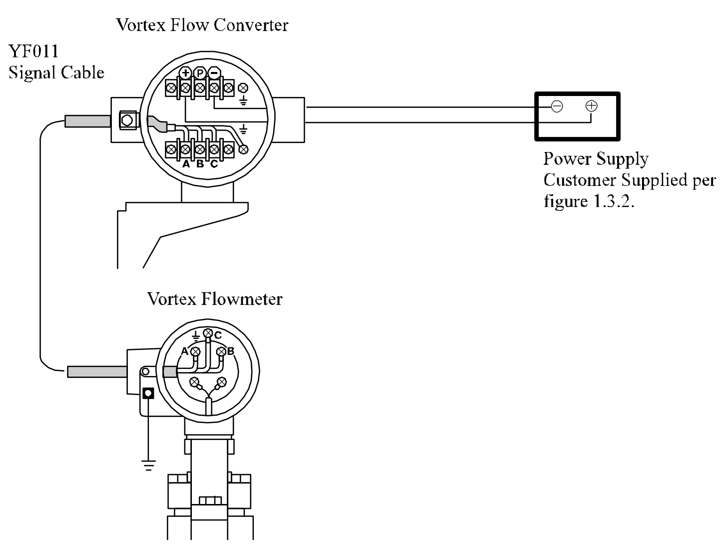

Figure 3.3.1: Wiring Connections (Analog) Remote Converter

Figure 3.3.2: Wiring Connections (Analog) Integral Converter

3.3.3 Pulse output, 3-wire type

When configured for pulse output mode, the converter requires three wires between the converter and the power supply. The required power should be between 18 and 30 VDC (allowable ripple +1.5 V or less). The pulse output (P terminal) is connected to a remote totalizer. The minimum load resistance of the pulse output loop is 10k ohms (maximum capacitance 0.22F, 0.1F for output frequency above 2.5 kHz), and interconnection wire resistance must be less than 50 ohms.

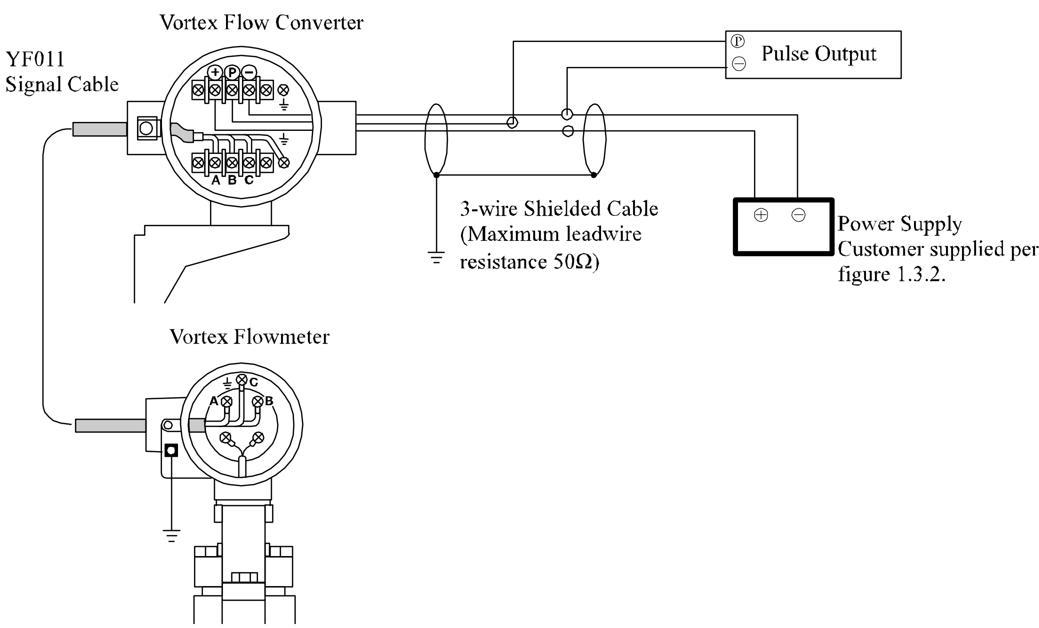

Figure 3.3.3: Wiring Connections (Pulse) - Remote Converter Type

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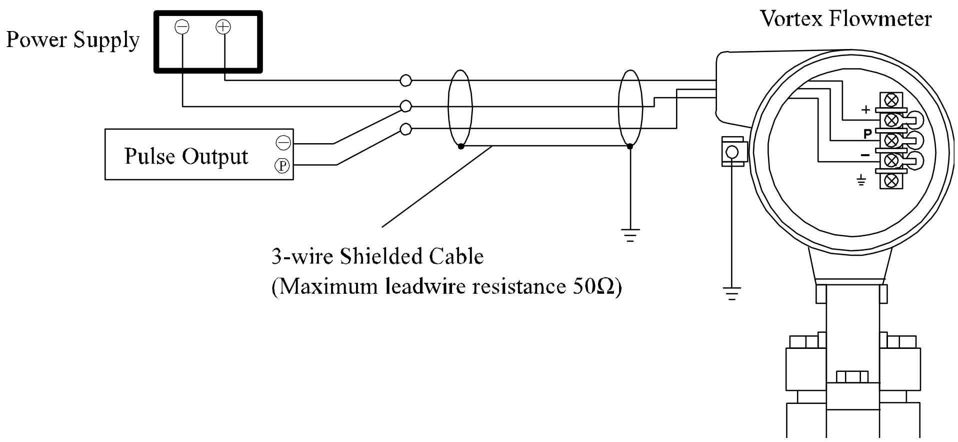


Figure 3.3.4: Wiring Connections (Pulse) - Integral Type

3.3.4 Interconnection for remote converter

When the converter is remotely mounted from the meter body, a special signal cable (YFO11) must be used. The maximum length of this cable is 65 feet (20 meters). The signal cable transmits a low level sensor signal from the remote flowmeter to the remote converter. The remote converter provides the output signals as described above. The remote signal wire connections are the same for either Analog or Pulse output units. The A, B and C terminals on the flowmeter are connected via the red, white and black wires (respectively) to the A, B and C terminals on the converter. The blue wire is connected on the converter end only to chassis ground. See figure 3.3.5.

For remote mounted converters there are two electrical conduit connections. Use the left connection, as viewed from the terminal side, for the signal wire (YFO11 cable) and the right connection for the output wiring. If the connection directions are reversed, the cover shield for the signal terminals cannot be installed.

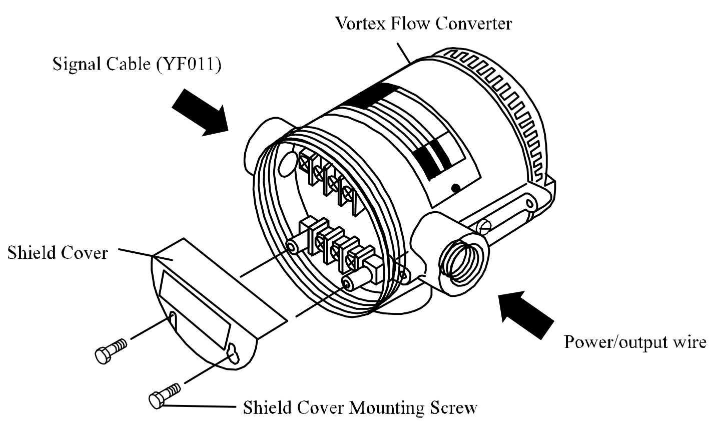


Figure 3.3.5: Shield Converter -Remote Type

3.4 CABLE

3.4.1 Field terminating the signal cable (YF011-0*E)

Both ends of the cable must be finished in accordance with the following instructions. The maximum cable length is 65 feet (20 meters). The YEWFLO cable is a special double-shielded cable available only from Yokogawa Industrial Automation. Proper termination is critical to ensure the meter performs as specified. **Do not splice additional cable to add length.** Please follow all steps completely.

If you are shortening the cable in the field, to simplify your work, cut off excess length from the flowmeter end of the cable only and re-terminate. The flowmeter end requires only three (3) termination's, while the converter end requires four (4).

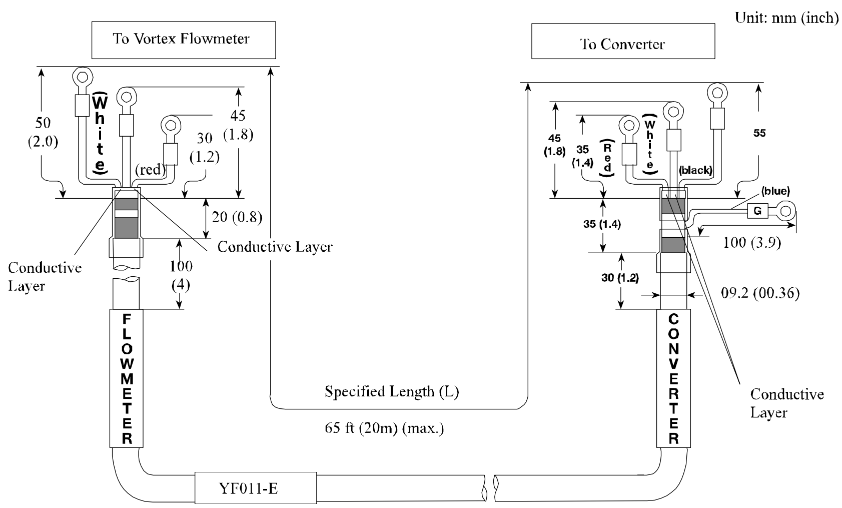
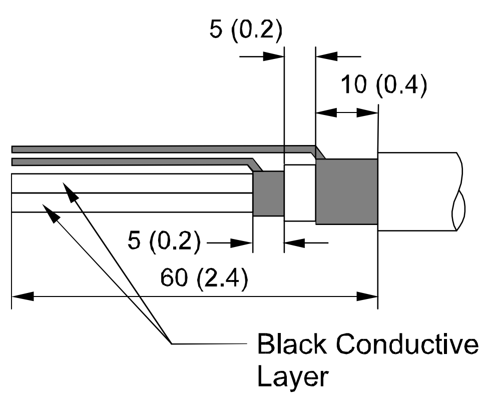


Figure 3.4.1: YF011 Signal Cable

Caution: Do not allow the "conductive layer" (black covering over signal wires A & B) to short to case ground or any other conductor. Please follow the termination procedure to insure proper termination and flowmeter performance.

Flowmeter end of the cable

1. Strip the outer polyethylene jacket, outer braided shield, inner jacket, and inner braided shield to the dimensions shown.



Caution: Don't cut the uninsulated drain wires.

2. Strip off the black conductive layer on each wire exposing the red or white insulation underneath to the

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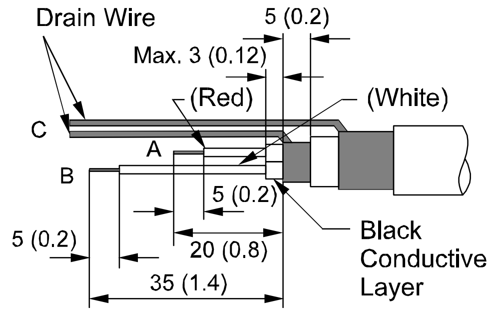
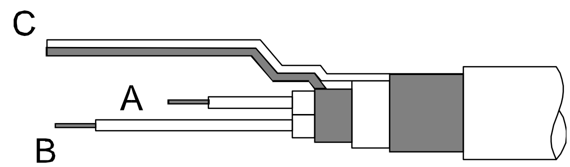
dimensions shown. Cut the length of each wire to the dimensions shown. Twist the strands of each wire and drain wire so there are no free strands.

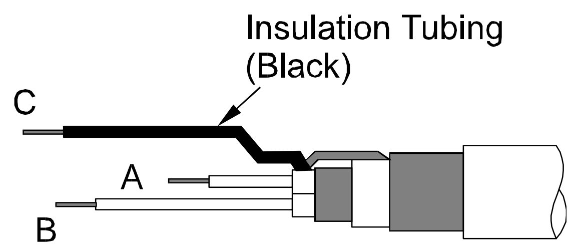


3. Do not allow the black conductive layer to short circuit to wires A, B, C or the metal Case.

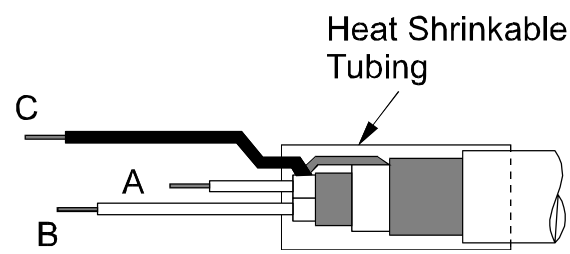
4. Strip off the red or white insulation to the dimensions indicated. Twist the outer and the inner drain wires (shields) together. You should now have 3 individual conductors.



5. Insert insulating tubing over the twisted drain wires, wire C, as far as possible. Cut the tubing off leaving only 0.2 inches (5 mm) of the drain wire exposed. Strip 0.2 inches (5 mm) of insulation from the tips of the remaining two wires, A and B.



6. Slide heat shrinkable tubing over the wire bundle such that it covers the braided shields, overlaps the outer jacket and the loose wires A, B, and C as shown. Be certain that this tubing insulates all shield wires from chassis ground, this will insure that the field ground remains isolated from the control room ground.



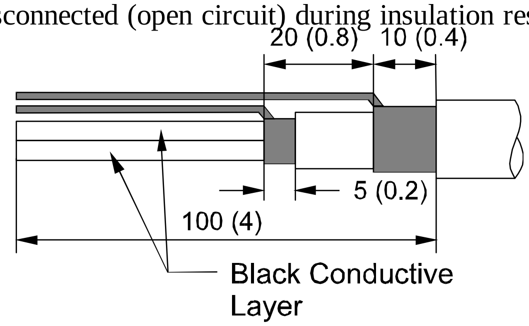
7. Install insulated crimp lugs on each wire A, B, and C.

8. Attach identifying labels to the outside of the signal cable.

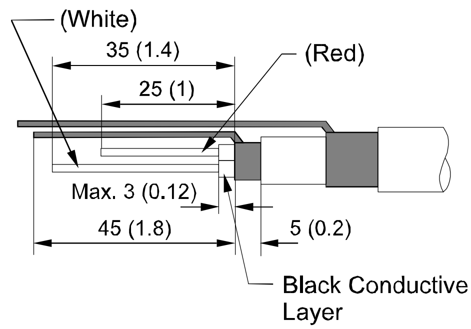
Confirm that the insulation between each wire including the inner shield is 10 Mega Ohm or greater at 500 VDC. Maintain both ends of the wires disconnected (open circuit) during insulation resistance (Hi-Pot) test.

Converter end of the cable

1. Strip the outer polyethylene jacket, outer braided shield, inner jacket, and inner braided shield to the dimensions shown. **Caution**: don't cut the drain wires.

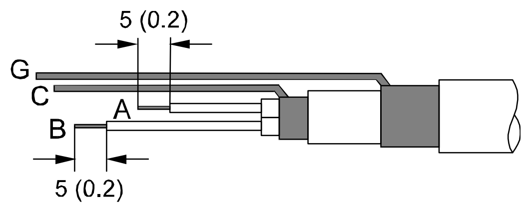


2. Strip off the black conductive layer on each wire exposing the red or white insulation underneath to the dimensions indicated. Twist the strands of each wire and drain wire so there are no free strands.

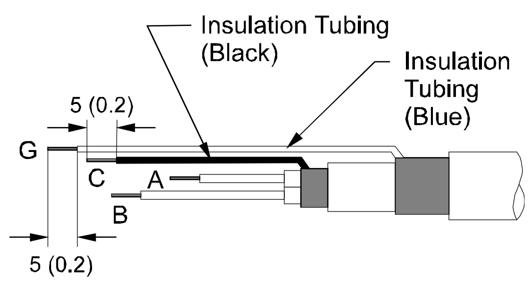


3. Do not allow the black conductive layer to short circuit to wires A, B, C, G or the metal case.

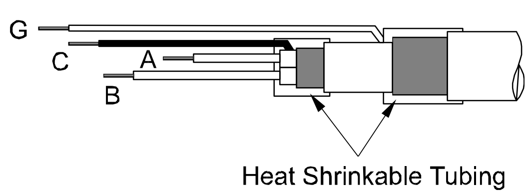
4. Strip off the red or white insulation to the dimensions indicated, and cut each wire to length as shown.



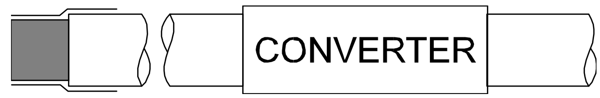
5. Insert blue insulating tubing over the outer shield drain wire (G), and black insulating tubing over the inner shield drain wire (C) as shown. Cut the tubing off exposing 0.2 inches (5 mm) of each drain wire. Strip 0.2 inches (5 mm) of insulation from the tips of the remaining two wires (A and B).



6. a) Slide heat shrinkable tubing over the entire wire bundle such that it overlaps the outer jacket, outer shield and the blue wire (G) as shown. Be certain that the outer shield is fully protected.



b) Slide another heat shrinkable tubing over the wire bundle such that it covers the inner braided shield, overlaps the inner jacket and the loose wires A, B, and C as shown. Be certain that the heat shrink tubing protects all shield wires from chassis ground. Heat the tubing as necessary to shrink it for a tight fit.



7. Install insulated crimp lugs on each wire A, B, C and G.

8. Attach identifying labels to the outside of each signal cable.

Confirm that the insulation between each wire including the inner shield is 10 Mega Ohm or greater at 500 VDC. Maintain both ends of the wires disconnected (open circuit) during insulation resistance (Hi-Pot) test.

3.5 WIRING CAUTIONS

When installing the YEWFLO in a hazardous area, particular care must be taken when wiring the meter not violate any of the requirements of the hazardous area approvals.

For explosionproof installations, the wiring must be protected by conduit and proper seals so hazardous material exposure is limited and consistent with the requirements of the approving agency (FM or CSA). If you are unsure about the requirements of the approving agency, consult their appropriate standards handbook.

3.5.1 Flameproof transmitter installation

The model YF100 vortex flowmeters and YFA11 vortex flow converters are designed to be used in hazardous areas, divisions 1 and 2. Their specific uses are outlined in "Recommended practice for explosion-protected electrical installations in general industries (Gas Explosion Protection, 1985)." To avoid damaging the flameproof equipment, connecting bolts, wiring and pipes should be installed with care. Caution should also be used for maintenance and repair of the equipment. For further information, refer to "Operating precautions for instruments of flameproof construction conforming to technical criteria (IEC-Compatible Standards)"

3.5.2 Cautions for insulation and dielectric strength testing

Since the flowmeter has undergone insulation and dielectric tests at the factory prior to shipment, these tests are normally not required again. However, if required, follow the precautions and procedures listed below:

1) Do not apply voltages exceeding 500 VDC for insulation resistance testing or 500 VAC for dielectric strength testing.
2) Before conducting these tests, disconnect signal lines from the flowmeter terminals.

•Insulation Resistance Test Procedure

1) Short-circuit the + and – (4-20 mA output type) or +, P and – (pulse output type) terminals in the terminal box.

2) Connect a plus (+) insulation tester leadwire to these terminals and the minus (–) leadwire to ground.
3) Turn the insulation tester power ON and measure the resistance between the two leads. Do not apply the voltage for more than two minutes.
4) After completing the test, disconnect the insulation tester. The short-circuiting wire between the + and – terminals should be connected to the ground terminal through a 100kΩ resistor allowing discharge of any internally charged static voltage. Do not make physical contact with these terminals until the voltage is completely discharged.

•Dielectric Strength Test

1) Short-circuit the + and – (4-20 mA output type) or +, P and – (pulse output type) terminals in the terminal box.
2) Connect a dielectric strength tester between the + and – terminals and the ground terminal. (Connect the dielectric strength tester positive (+) leadwire to the short-circuited terminals and negative (–) leadwire to the transmitter ground terminal.)
3) Gradually increase the test voltage from 0 to the specified voltage.
4) When the test voltage is obtained, maintain it for one minute.
5) After completing this test, slowly decrease the voltage to avoid any voltage surges.

3.5.3 Instruction document for FM explosionproof instruments

Wiring

- *All wiring shall comply with the national electrical code ANSI/NFPA70 and local electrical codes.*
- *In hazardous locations, wiring shall be placed in a conduit.*

Operation

- ***WARNING**: Do not open the cover while the circuit is alive.*
- *Avoid generating mechanical sparks when near the instrument and peripheral devices in hazardous locations.*

Maintenance and Repair

- *Instrument modification or replacement parts provided by anyone other than an authorized representative of Yokogawa Industrial Automation is prohibited and will void the Factory explosionproof certification.*

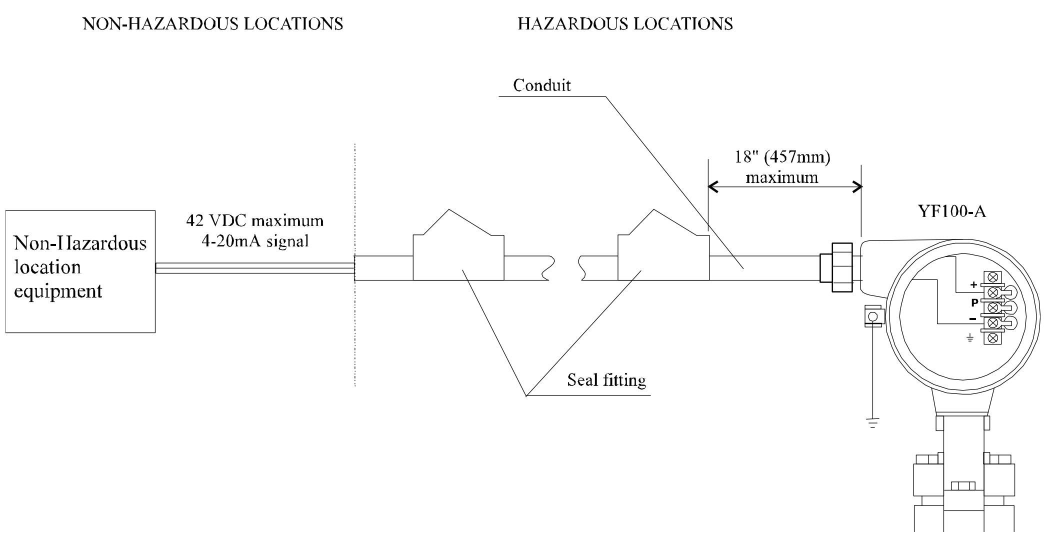


Figure 3.5.1: Integral Type

(A) YF100-A series Vortex flowmeters can be used in the following hazardous areas:

- *Explosionproof for Class I, Division 1, Groups B, C and D.*
- *Dust ignition-proof for Class II, Division 1, Groups E, F and G*
- *Suitable for Class III, Division 1*
- *Outdoor hazardous locations, NEMA 4*

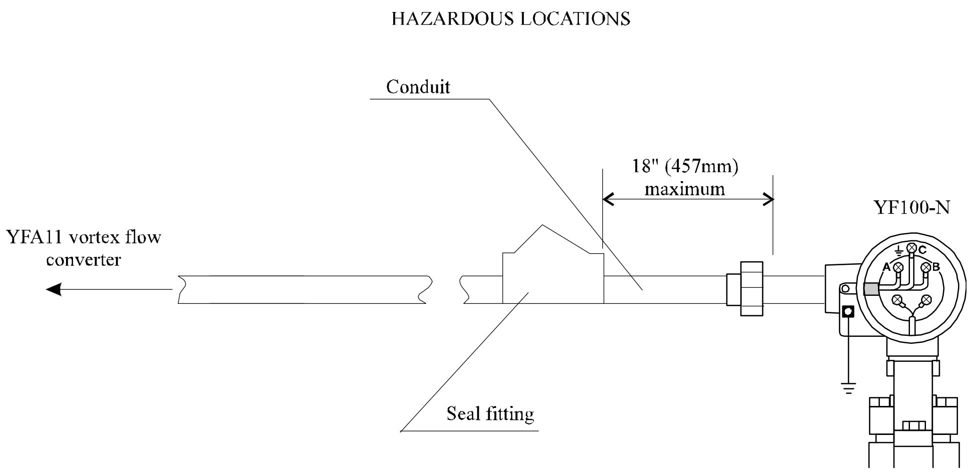


Figure 3.5.2: Remote Type

(A) YF100-N series Vortex flowmeters can be used in the following hazardous areas:

- *Explosionproof for Class I, Division 1, Groups B, C and D.*
- *Dust ignition-proof for Class II, Division 1, Groups E, F and G*
- *Suitable for Class III, Division 1*
- *Outdoor hazardous locations, NEMA 4*

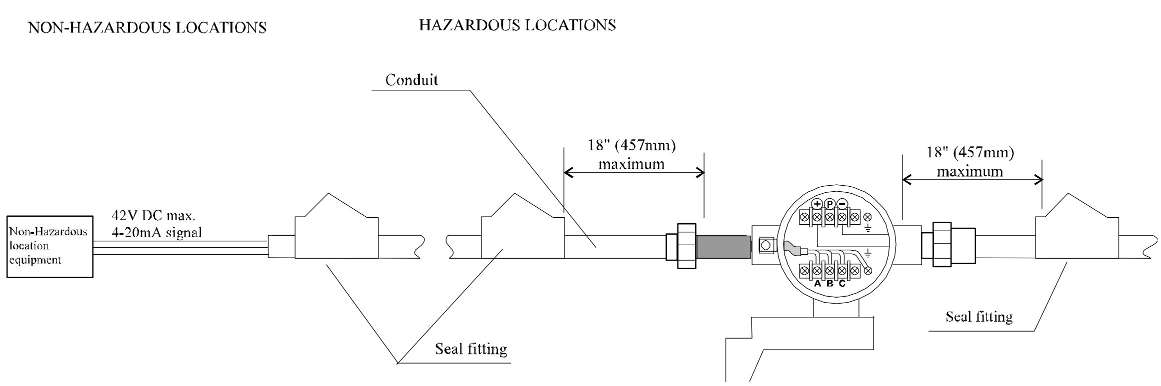


Figure 3.5.3: Remote Converter

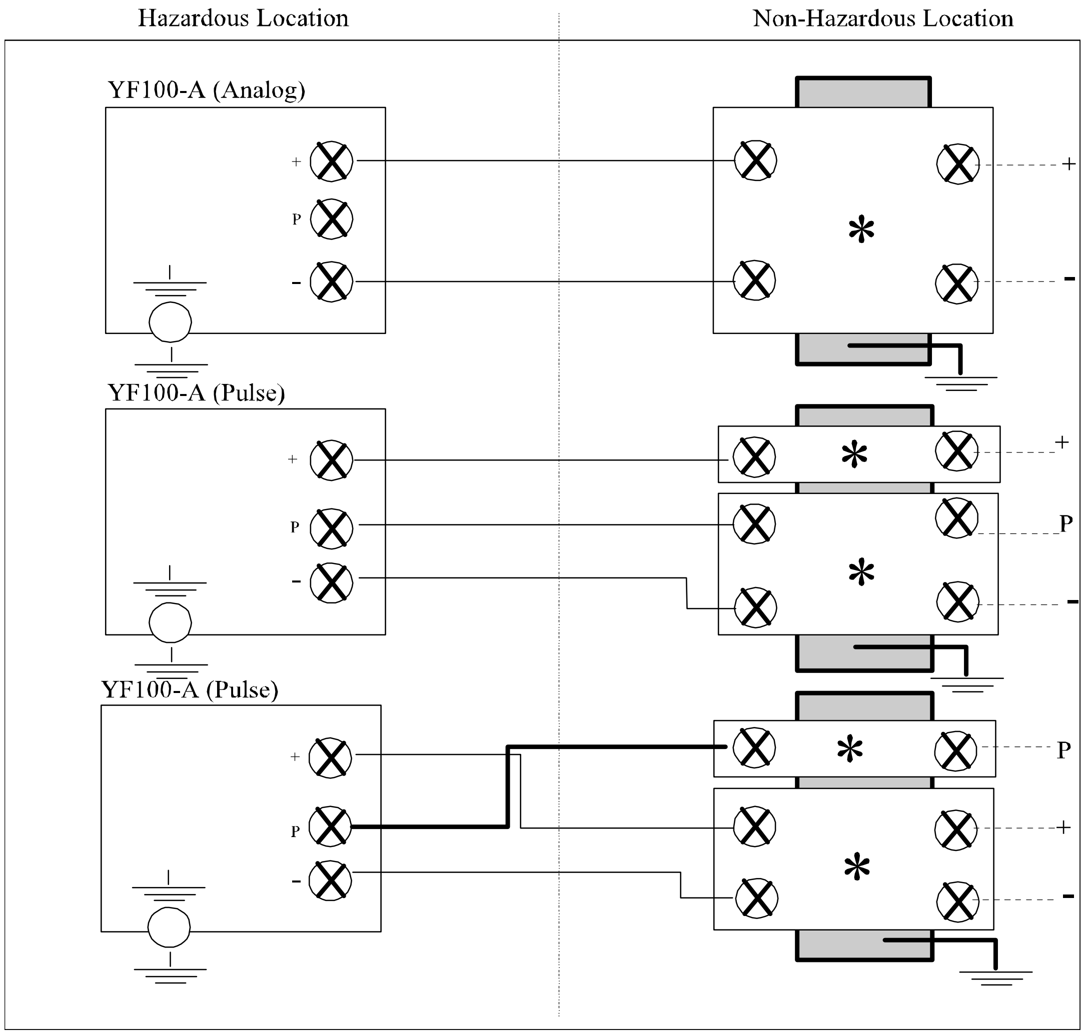
(A) YFA11 series Vortex flowmeters can be used in the following hazardous areas:

- *Explosionproof for Class I, Division 1, Groups B, C and D.*
- *Dust ignition-proof for Class II, Division 1, Groups E, F and G*
- *Suitable for Class III, Division 1*
- *Outdoor hazardous locations, NEMA 4*

3.5.4 Wiring cautions for CSA intrinsic safety

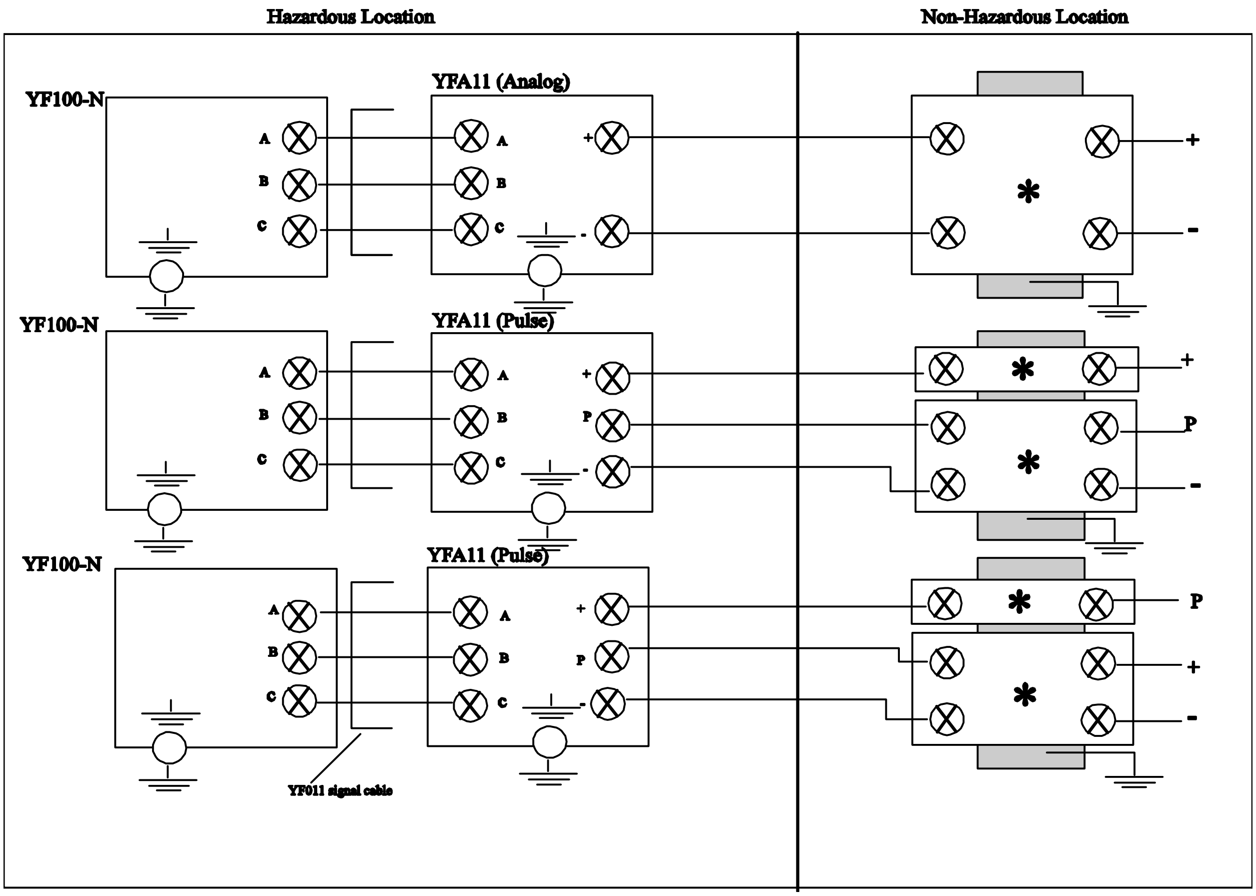
If the meter is to be installed in an intrinsically safe system, safety barriers must be installed to prevent excessive power from entering the hazardous area.

•Integral Installation



Doc. No. ICS002-A12 p. 1
*CSA certified barrier with parameters of 28V/300 ohms.

•Remote Installation

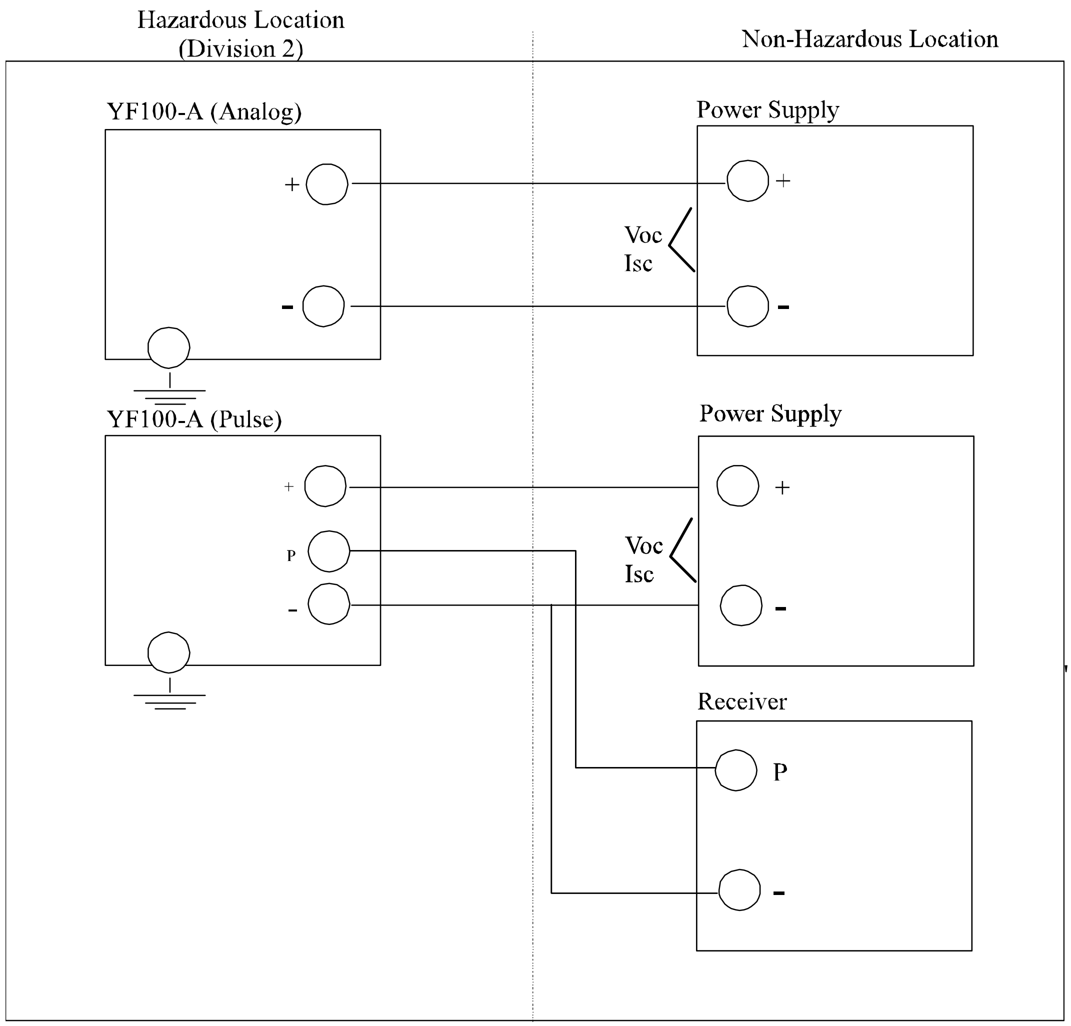


Doc. No. ICS002-A12 p. 1
*CSA certified barrier with parameters of 28V/300 ohms.

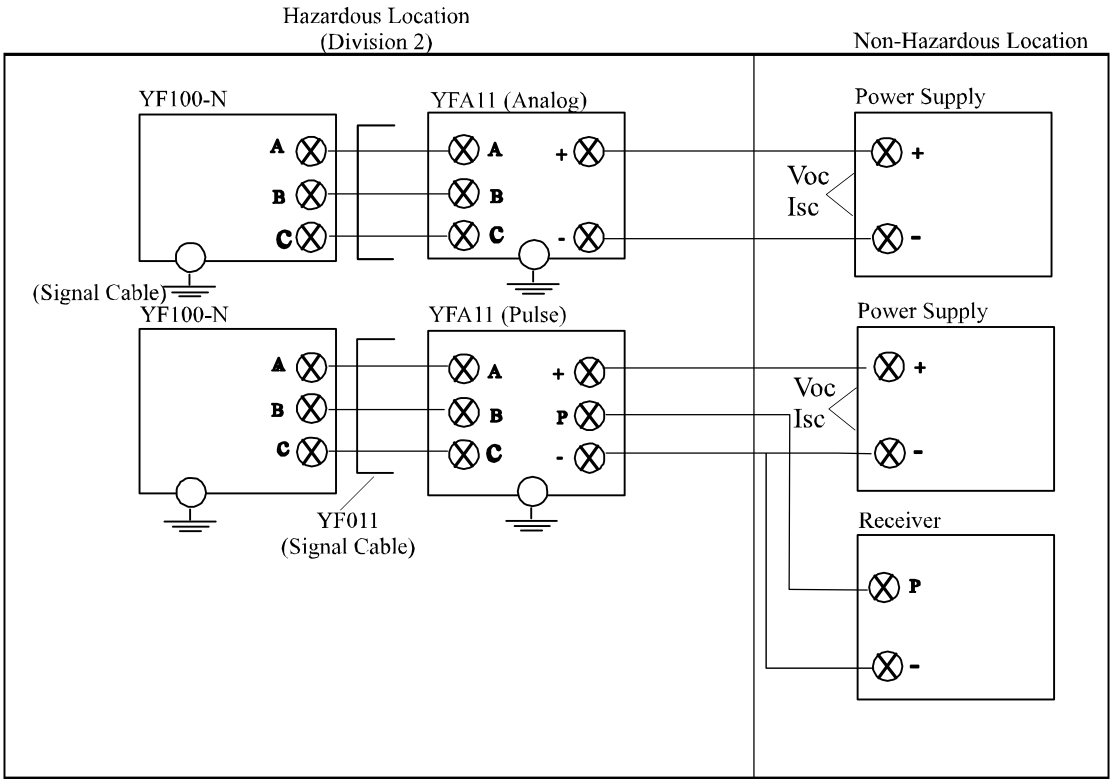
3.5.5 Wiring cautions for FM intrinsic safety

If the meter is to be installed in an FM intrinsically safe system, safety barriers must be installed to prevent excessive power from entering the hazardous area.

•Non-incendive Integral Installation



•Non-incendive Remote Installation



Non-incendive Parameters:

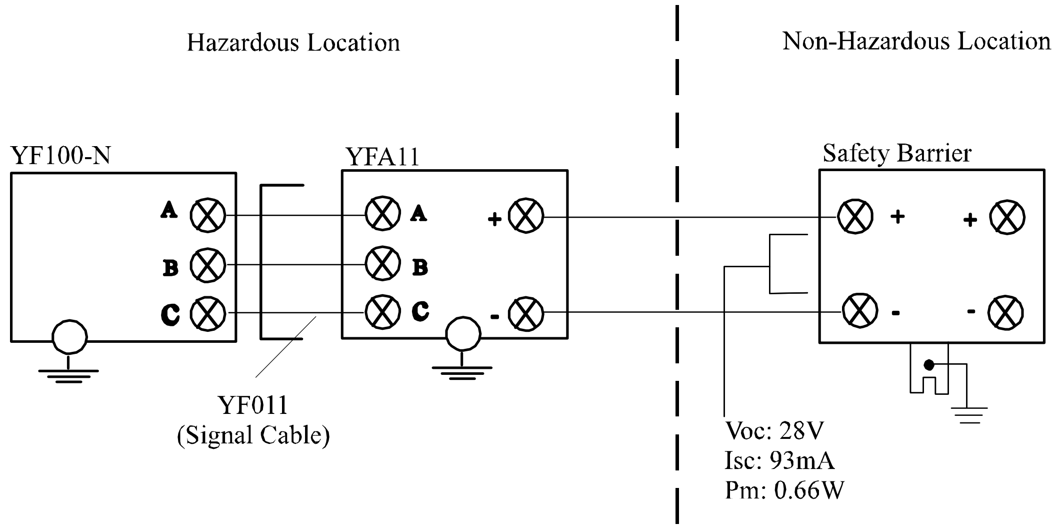
Vmax = 28V, Imax = 93mA, Ci = 4nF (analog output), Ci = 62nF (pulse output), Li = 0

Vmax $\geq$ Voc, Imax $\geq$ Isc, Ca $\geq$ Ci + Ccable, La $\geq$ Li + Lcable

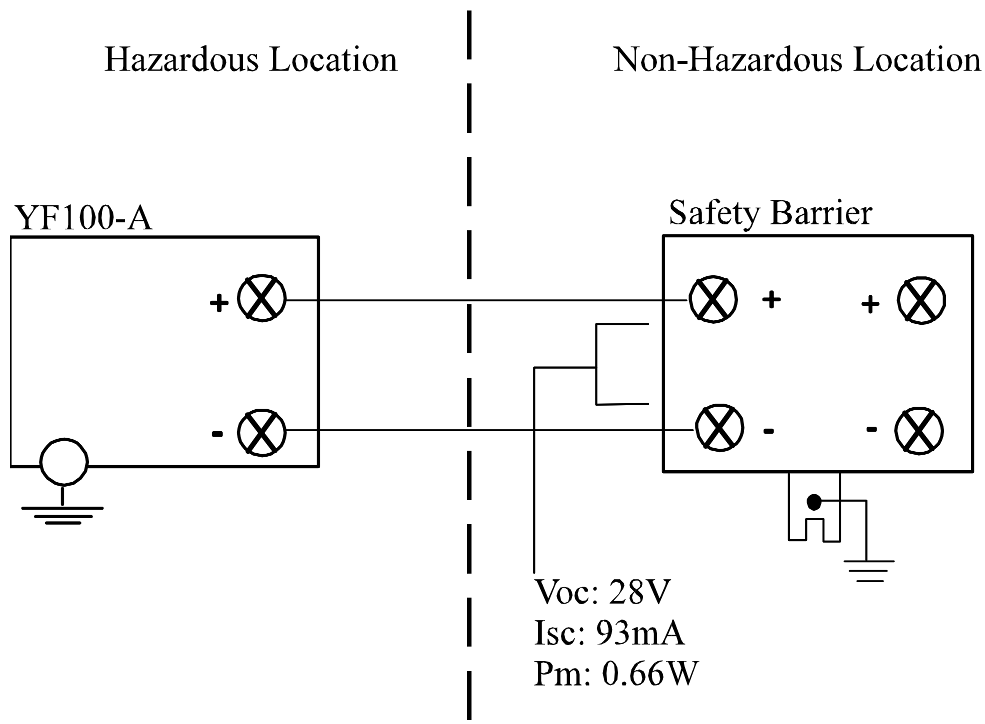
Notes:

1. Division 2 power source must be FMRC approved.
2. Control room equipment connected to the power supply must not use or generate more than 250V.
3. YF011 Signal Cable max length 131 ft. (40 m).

•Intrinsically Safe Remote Installation



•Intrinsically Safe Integral Installation



•Max. Entity Parameters
Vmax = 28 Vdc
Imax = 93 mA
Pmax = 0.66W

	Analog Output	Pulse Output
Ci	4 nF	62 nF
Li	0 mH	0 mH

•Installation Requirements
Vmax > Voc or Vt
Imax > Isc or It
Ca > Ci + Ccable
La < Li + Lcable

Notes:

1. YF011 signal cable max length 20 meters.
2. Maximum non-hazardous location voltage must not exceed 250v.
3. Do not alter drawing without authorization from FMRC.
4. Installation should be in accordance with ANSI/ISA RP12.6. "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
5. Approved dust-tight seals are required for Class II and III installations.

IV. MAINTENANCE

4.1 HOW TO...

The following how to lists are described in this chapter.

4.1.1 Communicating with the YEWFLO remotely
4.1.2 Adjusting zero and span
4.1.3 Using self-diagnostics
4.1.4 Simulating an output/performing a loop check
4.1.5 Changing the output mode to analog or pulse
4.1.6 Increasing gas and steam flow measurement accuracy by correcting for gas expansion
4.1.7 Activating Reynolds number correction
4.1.8 Activating mismatched pipe schedule (bore) correction
4.1.9 Setting up and resetting the internal totalizer
4.1.10 Scaling the pulse output
4.1.11 Setting up user defined flow units
4.1.12 Setting up the local LCD indicator display mode
4.1.13 Setting the low cut flowrate
4.1.14 Trimming the 4-20 mA analog output
4.1.15 Using the upload/download feature

For information on the following items, please refer to the noted reference points.

Adjusting trigger level adjustment (TLA) .... see signal conditioning
Adjusting noise balance .... see signal conditioning
Adjusting noise judge.. see signal conditioning
Connecting an oscilloscope to read the output from the YEWFLO .... see troubleshooting
Minimizing the affects of noise .... see signal conditioning
Sizing a YEWFLO .... refer to YEWFLO sizing software
Calculating pressure drop through a flowmeter... refer to YEWFLO sizing software
Driving an output by inputting a frequency... see amplifier calibration

4.1.1 Communicating with the YEWFLO remotely

The BT100/BT200 may be connected directly to terminals on the amplifier to communicate. **You must direct connect to communicate when the output jumpers are set for pulse output.** With analog output configuration, you may communicate either on the 4-20 mA loop wires or via a direct connection. The following conditions must exist in either case for communication to operate properly.

Analog output mode

1. 250Ω to 600Ω of resistance must be in the loop, even for direct amplifier connection.
2. The output jumpers on the amplifier must be set to the analog position.
3. The vortex meter must be powered by 18.5 to 42 VDC. For proper communication at the meter terminals, the ripple should be ≤ 100 mVAC. Refer to figure 1.3.2 for power supply requirements.
4. Attach one end of the BT100/200 communication cable to the top of the communicator.
5. For Analog mode, there are two ways to communicate as follows:
   A. Local Communication: Attach the other end of the communication cable to the HHT ANALOG terminal and the HHT COM terminal on the amplifier itself. These connection points are labeled per above and color coded with a yellow bead. Polarity does not matter.
   B. Remote Communication: Connect the handheld terminal to the 4-20 mA signal wires, such that at least 250Ω of the loop load is between the leads. Polarity does not matter.

Pulse output mode

1. The output jumpers on the amplifier must be set to pulse position.
2. The vortex meter must be powered by 14 to 30 VDC.
3. Attach one end of the BT100/200 communication cable to the top of the communicator.
4. On a pulse output vortex meter there is NO requirement for 250Ω of resistance.
5. For Pulse mode, only local communication is supported.
   A. Attach the other end of the communication cable to the HHT PULSE terminal and the HHT COM terminal on the amplifier itself. These connection points are labeled per above and color coded with a yellow bead. Polarity does not matter.

Communication Start-up

<table>
<tr><th></th><th>BT200 handheld terminal</th><th>BT100 handheld terminal</th></tr>
<tr><td rowspan="2">1.</td><td>Power up by pressing the ON / OFF key..</td><td>Power up by pressing the POWER key.</td></tr>
<tr><td colspan="2">The WELCOME message indicates the handheld terminal is working properly.</td></tr>
<tr><td>2.</td><td>Press ENTER and a screen of information such as YEWFLO*E showing what instrument you are connected to, TAG NO., and SELF CHECK status, is displayed.</td><td>Press MENU (or any key) and YEWFLO*E is displayed showing your instrument connection.</td></tr>
<tr><td>3.</td><td></td><td>Press menu (or any key) again and TAG NO. is displayed.</td></tr>
<tr><td rowspan="2">4.</td><td></td><td>Press menu (or any key) again to display SELF CHECK status.</td></tr>
<tr><td colspan="2">At this point you are ready to begin configuring or otherwise interrogating the YEWFLO parameters.</td></tr>
<tr><td>5.</td><td>Pressing ENTER again (F4 soft key OK) will display a list of menus to choose from.</td><td>Pressing menu (or any key) again will take you to the A:DISPLAY menu - the top of all menus.</td></tr>
</table>

This process completes start-up of communication. Once you are successfully communicating, please refer to the appropriate “How To” section to help you make the configuration change desired. If you receive a Comm.Error recheck the connections as described above, and insure that the batteries in the handheld terminal are fully charged. Refer to figure 4.5.1 for a connection diagram.

4.1.2 Adjusting zero and span

Zero Adjustment

There is **no zero adjustment required** on the YEWFLO. This is a procedure frequently required on other types of flowmeters but is not applicable to the YEWFLO vortex flowmeter. If the vortex meter provides an output in a no flow situation refer to the signal processing section or troubleshooting section of this manual.

Span Adjustment

All YEWFLO vortex meters, both analog and pulse output units, require an initial span setting. If you provided the correct process conditions at the time of your order, span has been preset at the factory. If it is necessary to change this value, follow this procedure to make a span adjustment.

<table>
<tr><th>Display</th><th>BT200 handheld terminal</th><th>BT100 handheld terminal</th></tr>
<tr><td>B :SET 1</td><td>Using the up/down arrows, scroll to the B :SET 1 menu and press ENTER.</td><td>Depress the Menu key until B :Set 1 menu appears.</td></tr>
<tr><td>B51: SPAN FACTOR
E+1</td><td>Use the up/down arrow keys to move through the parameter list until B51: SPAN FACTOR is displayed, press ENTER.</td><td>Using the prmtr key move through the parameter listing until B51 :Span Factor appears.</td></tr>
<tr><td></td><td colspan="2">Select the desired SPAN FACTOR from the list. If the span value is greater than 32,000 an exponential SPAN FACTOR (x 10 multiplier) must be used. For example, a span value of 75,000; the flow span (B52) would be set to 7,500 and the SPAN FACTOR would be set to E+1 (10^1). 7,500 x 10^1 = 75,000.</td></tr>
<tr><td></td><td>Use the arrow keys to scroll through the choice list, press ENTER twice. Press F4, OK.</td><td>Use the INC or DEC key to move through the choice list, press ENT twice.</td></tr>
<tr><td>B52 :FLOW SPAN
7,500</td><td>Use the arrow key to move to B52 :FLOW SPAN . Press ENTER.</td><td>Press the PRMTR key once to move to parameter B52 :FLOW SPAN</td></tr>
<tr><td></td><td colspan="2">Input the flow span using the numeric keys</td></tr>
<tr><td></td><td>Press ENTER twice. Press F4, OK.</td><td>Press ENT twice.</td></tr>
</table>

4.1.3 Using self-diagnostics

From any menu you have access to the self-diagnostics in the YEWFLO.

```
X60 :Self CHECK
GOOD
```

BT200 handheld terminal	**BT100** handheld terminal
From the menu screen, select any menu and press **ENTER**, to enter parameter display mode. Press **F2**, the DIAG soft key. You may also scroll down to the "60" parameter in the current menu.	Press the **DIAG** key and you will immediately run diagnostics, and the display will show X60:SELF CHECK with either a GOOD or ERROR display. Note X denotes the alphabetic value of the current menu.
If error is displayed, press the **ENTER** key to display an alphanumeric list of the error or errors. Scroll down to be sure all error messages are seen. Press **F4** (ESC) function to return to the menu screen.	If error is displayed, press **INC** or **DEC** to view the alphanumeric description of the error. Continue pressing the **INC** or **DEC** key to scroll through the error list if there is more than one.

As you resolve each condition that is causing an error, the error will automatically be cleared. To confirm that all errors have been corrected, please perform Step 1 again.

Refer to the error code listing chart for a detailed description of each error message.

4.1.4 Simulating an output/performing a loop check

The YEWFLO provides the flexibility to simulate an output to perform a loop test. This feature can be used for Analog output or Pulse output configurations.

Analog Output - simulate output (parameter* B02:OUTPUT *must be set to* 4-20 mA DC*)

Display
F :TEST

BT200 handheld terminal	**BT100** handheld terminal
From the menu screen scroll down to the **F: TEST** choice. Press **ENTER**.	Depress the **m enu** until the **F: TEST** menu is displayed.

Display
F01: OUT ANALOG **50**

Select **F01: OUT ANALOG** parameter. Press **ENTER**.	Press the **prmtr** once to display parameter **F01: OUT ANALOG**.
Using the numeric keys, enter the value of percent of span you wish to simulate. i.e. 50%	
Press **ENTER** twice.	Press the **ENT** twice.
The current output, and the percent of rate display will agree with the value entered in parameter **F01**. However, the engineering units display and totalization will continue to read and totalize the actual flowrate.	

	Note: Two methods cause the simulated output to return to normal flow reading.	
1)	Press the **F 4** (**ESC**) function key.	Move to any other menu or parameter, by pushing the **MENU** or **PRMTR** key.
2)	After 10 minutes the output will automatically return to normal.	

Pulse Output - simulate output (Parameter B02:OUTPUT must be set to PULSE)

Display
F :TEST

BT200 handheld terminal	**BT100** handheld terminal
From the menu screen scroll down to the **F:TEST** choice. Press **ENTER**.	Depress the menu key until the **F:Test** menu is displayed.

Display
F01: OUT pulse **2000**

Scroll down to parameter **F02: OUT PULSE**. Press **ENTER**.	Press the **prmtr** twice to display **F02: Out Pulse**.
Use the numeric keys, enter the frequency value in Hertz you wish to simulate. i.e. 2000 Hz.	
Press **ENTER** twice.	Press the **ENT** twice.
The frequency output will respond to the value entered. **Note:** The pulse output, will agree with the value entered in parameter **F01.** However, the percent of span display, engineering units display and totalization will continue to read the actual flowrate.	

	Two methods cause the simulated output to return to normal flow reading.	
1)	Press the **F 4** (**ESC**) function key.	Push the **M enu** or **PRMTR** key to move to another menu or parameter.
2)	After 10 minutes, the output will automatically return to normal.	

4.1.5 Changing th e output mode to analog or pulse

Changing the output to Analog output

On the amplifier, move the 3 individual output jumpers to the “analog” position, these are the 3 pins on the right as you look at the amplifier board. Refer to figure 1.3.2 for power supply requirements. This step must be completed before proceeding. NOTE: To communicate in analog output mode you must have a current loop load of 250Ω 600Ω.

After connecting the communication cable to the **BT100/200** connect the clip leads on the other end to the HHT ANALOG and HHT COM terminals of the amplifier, or on the 4-20 mA signal wires. Power up the **BT100/200** and proceed with the following steps:

Display	**BT200** handheld terminal	**BT100** handheld terminal
B: SET 1	From the menu screen, select B: SET 1 using the up/down arrows, scroll to and press the **ENTER** key.	Press the **MENU** key until the B: Set 1 menu is displayed.
B02: OUTPUT 4 to 20 mA DC	Using up/down keys select B02: OUTPUT and press the **ENTER** key.	Press the **parameter** key until parameter B02 : Output is displayed.
	Using the up/down arrows, select 4 to 20 mA DC and press the **ENTER** key twice. Then press **F4**, OK.	Using the **INC** and **DEC** key display the available options. When 4 to 20 mA DC is displayed press the **ENT** key twice.

Changing the output to Pulse output

On the amplifier move the 3 individual output jumpers to the “pulse” position, these are the 3 pins on the left as you look at the amplifier board. Refer to figure 1.3.2 for power supply requirements. This step must be completed before proceeding. NOTE: You cannot communicate remotely in the pulse output mode.

After connecting the communication cable to the BT100/200 connect each alligator clip to the HHT pulse and HHT COM terminals of the amplifier. Turn the power on the BT100/200 and proceed with the following steps.

Display	**BT200** handheld terminal	**BT100** handheld terminal
B: SET 1	From menu screen, use the arrow keys to select B: SET 1 and press the **ENTER** key.	Press the **MENU** key until the B: Set 1 menu is displayed.
B02: OUTPUT PULSE	Use up/down arrows keys to scroll to B02: OUTPUT . Press **ENTER**.	Press the **PRMTR** key until parameter B02: Output is displayed.
	Use the arrow keys to select PULSE and press **ENTER** twice. Then, press **F4**, OK.	Use the **INC** or **DEC** key to select Pulse and press the **ENT** key twice.

4.1.6 Increasing gas and steam flow measurement accuracy by correcting for gas expansion

To achieve the highest level of performance from a vortex meter when measuring a compressible fluid, YEWFLO offers a gas expansion factor which will automatically make the necessary correction and improve gas accuracy to ±0.8% of rate over the full operating range. Without the gas expansion factor, the standard accuracy is 1.5% of rate.

The pressure drop across the shedder bar increases with increasing flowrate. As the pressure drop increases, the gas expands. Gas expansion due to the higher pressure drop will cause the vortex flowmeter to read high. To compensate for this velocity activate the D06: EXPANSION FA parameter. To activate this function, please follow the steps below:

NOTE: Do not activate this function for liquid flow applications. Review the setting of parameter B04: FLUID to confirm the settings are for Gas or Steam only.

Display	**BT200** handheld terminal	**BT100** handheld terminal
D :ADJUST	Proceed to the menu screen and select the D: ADJUST and press **ENTER**.	Press the **MENU** key to move to the D: Adjust menu.
D06 :EXPANSION FA ACTIVE	Scroll through the parameters to D06 :EXPANSION FA and press **ENTER**.	Using the **PRMTR** key move to parameter D06 :Expansion FA.
	Using the arrow keys, select ACTIVE and press **ENTER** twice. Then, press **F4**, OK.	To activate this feature use the **INC** or **DEC** key to select active and press **ENT** twice.

4.1.7 Activating Reynolds number correction

What is Reynolds Number Correction?

The YEWFLO vortex meter's output is linear beginning at 20,000 Reynolds number, or 40,000 for sizes 6 inch and above. From 5,000 to 20,000 Reynolds number the meter's output is nonlinear, but repeatable. Reynolds number adjustment is a correction factor applied to the output to compensate for this non-linearity within this Reynolds number range. When activated, flowmeter accuracy is improved to 0.8% of rate throughout the flow range above 5000 Reynolds number. The correction factors listed below are automatically applied when this feature is activated.

	BT200 handheld terminal	**BT100** handheld terminal
D: adjust	Select the **D: adjust** menu and press **en t er**.	Press **M en u** until the **D: Adjust** menu appears.
D01: Reynolds adj **Active**	Scroll to the first parameter, **D01: Reynolds adj**, press **en t er**.	Depress the **PRMTR** key and move to the first parameter **D01: Reynolds Adj**.
	Scroll to the **active** selection and press **en t er** twice.	Using **INC** or **DEC** select **active** and press **en t** twice.
	Press **F4** {ESC} to return to the parameter list.	
D02: viscosity **1.0**	Select parameter **D02: viscosity** and press **en t er**.	Press **PRMTR** to move to **D02: viscosity.**
	Input the flowing viscosity in centipoise	
	Press enter twice, Press **f4** {esc} to return to the parameter list.	Press **en t** twice.
D03 :Density F **8.3**	Scroll to parameter **D03: DENSITY F** and press **en t er**.	Using the parameter key move to the **D03: DENSITY F** parameter.
	Input the flowing density in units per B07.	
	Press **ENTER** twice.	Press **en t** twice.

The flowmeter will now be corrected for flowrates between 5,000 and 20,000 Reynolds number. Please be sure to input accurate viscosity and density values, as this correction is only as valid as the accuracy of these parameters. If viscosity and density change, accuracy will be affected until the new values are input.

Note: There are certain conditions where performance in the range of 5,000 to 20,000 Reynolds number is not possible. Please consult the YEWFLO sizing program, your local representative or the Yokogawa Industrial Automation factory for clarification.

Reynolds #	40,000	20,000	12,000	8,000	5,500
Correction	0%	-1.0%	-3.6%	-6.5%	-11.4%

4.1.8 Activating mis-matched pipe schedule (bore) correction

The mating pipe in a vortex meter installation should be schedule 40 pipe, using other schedule pipes can cause small errors. If a pipe schedule other than schedule 40 is being used the error can be corrected using the pipe effect correction.

Mis-matched pipe schedule correction

Display	**BT200** handheld terminal	**BT100** handheld terminal
D: adjust	Select menu D: adjust and press **en t er**.	Press **m en u** until d: adjust is displayed.
d05: pipe effect **Wafer Sch80**	Scroll to the **d**05: pipe effect parameter and press **en t er**.	Press the **p r m t r** key until the D05: pipe effect menu appears.
	Select from the list the correct combination of process connection (wafer or flange) and pipe schedule, (Sch10, Sch80 etc.), and press **en t er** twice.	Using the **i n c** or **d ec** keys, select the correct combination of process connection and pipe schedule, press **en t** twice.

Pipe schedule correction is now invoked, and accuracy will be corrected for the combination selected.

Model	Size	Wafer			Flange		
		Sch 10 (%)	Sch 40	Sch 80 (%)	Sch 10 (%)	Sch 40	Sch 80 (%)
YF101	½" (15 mm)	0	No Correction	-0.8	0	No Correction	0.1
YF102	1" (25 mm)	0		-0.7	0		0.1
YF104	1½" (40 mm)	-0.2		-0.3	0		0.1
YF105	2" (50 mm)	0.1		-0.9	0		0.1
YF108	3" (80 mm)	0.2		0.2	0.1		0
YF110	4" (100 mm)	0.2		-0.1	0.1		0
YF115	6" (150 mm)	NA	NA	NA	0.3		-0.1
YF120	8" (200 mm)	NA	NA	NA	0.3		-0.1
YF125	10" (250 mm)	NA	NA	NA	0		0
YF130	12" (300 mm)	NA	NA	NA	0		0

4.1.9 Setting up and resetting the internal totalizer

Setup of the internal totalizer

Display	**BT200** handheld terminal	**BT100** handheld terminal
C: SET 2	Scroll through the menus to the C: SET 2 , then press **ENTER**.	Press the **MENU** key until the C: Set 2 menu appears.
C01: Total Rate	Scroll down to C01: Total Rate and press **ENTER**.	Press **prmtr** key to move to parameter C01: Total Rate.
	Scroll to the desired totalizer factor, press **ENTER** twice.	Use the **INC** or **DEC** key to select the desire totalizer factor. Press **ENT** twice.
	The available options for totalizer rates include scaled and unscaled rates	
	Examples:	
	E 0	1 count equals one unit of flow (10^0) , units same as flow unit.
	E +2	1 count equals 100 units of flow (10^2) , units same as flow unit.
	E -2	1 count equals 0.01 units of flow (10^{-2}) , units same as flow unit.
	There are three special settings designed to maximize resolution:	
	UNSC * 1	1 pulse in, 1 count out (Unscaled)
	UNSC * 10	1 pulse in, 10 counts out (Unscaled)
	UNSC * 100	1 pulse in, 100 counts out (Unscaled)
	Note: Set this parameter such that the maximum count or pulse rate does not exceed 6,000 Hz.	

Note: When factors other than E0 are used the appropriate multiplier sticker should be placed on the bezel of the local indicator, if present (/TBL).

Resetting the internal totalizer

Display	**BT200** handheld terminal	**BT100** handheld terminal
E: CONTROL	Scroll to the E: CONTROL menu and press **ENTER**.	Press the **MENU** key until the E: Control menu appears.
E01: TOTAL RESET execute	Scroll to parameter E01: TOTAL RESET and press **ENTER**.	Press the **PRMTR** key once to display the parameter E01: Total Reset.
	Scroll to the value Execute and press **enter** twice to reset the totalizer.	Use the **INC** or **DEC** key to select execute and press **ent** twice to reset the totalizer.

Note: This parameter will automatically revert to NOT EXECUTE, when you exit the parameter.

4.1.10 Scaling the pulse output

Before setting the pulse rate be sure that the YEWFLO has been properly set to pulse output mode. The pulse output of the YEWFLO may be configured as a scaled or unscaled pulse output. Follow this procedure to set the pulse scaling. Use scaled pulse to scale the output to pulses per engineering unit per B51 Flow span units. Use unscaled pulse (UNSC*1, UNSC*10 or UNSC*100) for maximum pulse resolution. Output will be 1, 10 or 100 pulses output for each input pulse. Use the K-factor to convert unscaled units to volume units.

Setup of pulse output

Display	**BT200** handheld terminal	**BT100** handheld terminal
C: SET 2	Scroll through the menus to the C: SET 2 , then press **ENTER**.	Depress the **MENU** key until the C: Set 2 menu appears.
C02: pulse rate **E +2**	Scroll down to C02: pulse rate and press **ENTER**.	Press **prmtr** key to move to parameter C02: pulse rate .
	Select from the list the desired pulse rate factor, press **ENTER** twice.	Use the **INC** or **DEC** key to select the desire pulse rate factor. Press **ENT** twice.

The available options for pulse rate include scaled and unscaled rates.	
Examples:	
E 0	1 pulse equals one unit of flow (10^0), units same as flow span.
E +2	1 pulse equals 100 units of flow (10^2), units same as flow span.
E - 2	1 pulse equals 0.01 units of flow (10^{-2}), units same as flow span.
There are three special unscaled settings designed to maximize resolution:	
UNSC * 1	1 pulse in, 1 pulse out (Unscaled)
UNSC * 10	1 pulse in, 10 pulses out (Unscaled)
UNSC * 100	1 pulse in, 100 pulses out (Unscaled)

Set this parameter such that the maximum count or pulse rate does not exceed 6,000 Hz at max flow span.

Note: Gas Expansion Correction Factor in % reading = (-5.70833 x E-4 x V^2) - (5.83333 x E-4 x V);
Where V = Average measured uncorrected velocity in m/sec

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4.1.11 Setting up user defined flow units

It is possible that the flow units required for a particular application may not be available as standard flow units. Therefore, YEWFLO offers the flexibility of setting custom user units for any application.

	BT200 handheld terminal	**BT100** handheld terminal
B :SET 1 **B35 :Flow unit** **USGAL** **B50 :Time Unit** **/m**	Scroll to the **B: SET 1** menu and press the **ENTER** key. Select a standard flow unit for parameters **B15**, **B22**, **B29**, or **B35** and select a standard time base for parameter **B50** from the available list. Make your selection from the list by scrolling to it and pressing **ENTER** twice.	Using the **menu** key move to the **B: SET 1** menu. Using the **PRMTR** key, select parameters **B15**, **B22**, **B29**, or **B35.** Then using the **INC** or **DEC** key, select a standard unit. Use the **PRMTR** key to select parameter **B50** and **INC** or **DEC** to select a standard time base.
	Only one of the above flow unit parameters will be available depending on whether your application is for Gas, Liquid, Steam or Energy flow as selected in **B04 :Fluid**.	
C: SET 2	From the menu screen scroll down to **C: SET 2** and press **ENTER**. Then, press **F4**, OK.	Press the **MENU** key until **C: Set 2** is displayed.
C09: UNIT CONV FA **0.0238**	Scroll down to **C09: UNIT CONV FA** and press **ENTER**. Using the numeric keys, enter the conversion factor and press the **ENTER** key twice. Press **F4**, OK.	Using the **PRMTR** key move through this menu until parameter **C09: Unit Conversion Fa** is displayed. Use the numeric keys, enter the conversion factor and press the **ENT** key twice.
	See below for how to calculate the correct conversion factor.	
C10: USERS UNIT **BBL**	Scroll to parameter **C10: USERS UNIT** and press the **ENTER** key. Enter the custom flow units abbreviation using the alphanumeric keys. Press **ENTER** twice to save.	Using the **PRMTR** key move to the **c10: users unit** parameter and enter the custom flow units abbreviation using the alphanumeric keys. Press **ENT** twice to save.

The **C09: Unit Conversion Fa** is defined as: Standard Units/Custom Unit
Example: Set up for span of 50 BBL/h (Barrels per hour)
B35: FLOW UNIT..................USgal; conversion = 42 USgal/BBL (oil) or .0238 BBL/USgal
B50: TIME UNIT................../h
C09: Unit Conversion Fa..Enter 0.0238 BBL/USgal
C10: USER'S UNIT ....Enter the abbreviation for barrels; BBL

After making the above modifications, the units of flow will now be barrels per hour, BBL/h. This unit will not appear on the /TBL indicator, but only when communicating with the BT100 or BT200. Parameter A20 will now indicate flowrate in BBL/h and parameter A30 will now totalize in Barrels, BBL.

NOTE: After making these settings, the value of parameter B52: FLOW SPAN must be set in custom user units, i.e. BBL/H or 50, for this example.

Setting parameter C09: Unit Conversion Fa to any value other than '0' activates the custom user units function. To clear this function set C09 to '0'.

4.1.12 Setting up the local LCD indicator display mode

The YEWFLO vortex meter offers a variety of display options. The following procedure will allow you to select which values are displayed, for your application.

Display	BT200 handheld terminal	BT100 handheld terminal
E: CONTROL	Scroll through the menus to the E: CONTROL menu, then press **ENTER**.	Press the **MENU** key until the E: Control menu is displayed.
E02: DISP SELECT **rate %**	Scroll to parameter E02: DISP SELECT then press **ENTER**.	Using the **prmtr** key move to parameter E02: Disp Select .
	Scroll to your desired choice, press **ENTER** twice.	Using **INC** or **DEC** move to the display option of your choice, press **ENT** twice to select.

Select one of the 6 display options for the local indicator.
The available options are:

rate %	Rate in percent of span.
rate	Rate in engineering units.
total	Totalized flow in engineering units.
rate%, total	Alternating display; rate in percent of span and total flow.
rate, total	Alternating display; rate in engineering units total flow.
rate, rate%	Alternating display; rate in engineering units and rate in percent of span.

4.1.13 Setting the low cut flowrate

The low cut flowrate is a digital cut-off that can be configured to force the analog or pulse output to 0% when the flow is below a predetermined value. This parameter is used especially to lock out erroneous flow signals that may occur below Qmin, where it may be desirable to have the meter drop to zero rather than provide erroneous readings.

To set the low cut flowrate; move to menu H:Maintenance , then move down to H07:L.C.Flowrate . Using the numeric keypad input the low flow cut-off flowrate in flow span units. Once this value is stored, any signal below the low cut flowrate will generate a 0% output.

H :Maintenance	**BT200** handheld terminal	**BT100** handheld terminal
H07 :L.C. Flowrate **10**	Move to parameter H07, input the desired low flow cut-off value in flow span units, i.e. 10 Gal/min.	
	Press **E n t er** twice.	Press **en t** twice.

4.1.14 Trimming the 4-20 mA analog output

The 4-20 mA analog output circuit is accurately calibrated at the factory using precision test equipment. Field adjustment of this circuit is rarely required. This adjustment should not be made when there is a suspected offset of the 4 mA point due to noise such as pipe line vibration, in this case, please refer to signal conditioning.

If you find it necessary to trim the 4 mA and/or 20 mA value, it can be adjusted digitally with the handheld terminal. An example of when to use this adjustment would be when there is a 250Ω resistor in the loop changing the output to 1 - 5 volts. If the resistor value is not exact, an offset error of either the 4 mA (1V) and/or 20 mA (5V) reading will occur.

To digitally trim the current output, refer to the following formula and example to determine the correct digital trim parameter settings. The parameter H08 :Trim 4mA is used to adjust the 4 mA (or 0%) output, and parameter H09 :Trim 20mA is used to adjust the 20 mA (or 100%)

<table>
<tr><th>H :Maintenance</th><th>BT200 handheld terminal</th><th>BT100 handheld terminal</th></tr>
<tr><td rowspan="3">H08 :TRIM 4ma
0.45 %</td><td>Move to parameter H08, re-enter the value shown, (.45 this example) press E n t er twice. The output will go to 0%. (Don’t press OK until you are ready to leave this parameter).</td><td>Move to parameter H08 and press en t twice.</td></tr>
<tr><td colspan="2">Read the analog output at 0% and record it as X (3.93mA this example).</td></tr>
<tr><td colspan="2">Record the original value of H08 (0.45 this example).</td></tr>
<tr><td rowspan="5">H09 :Trim 20ma
1.25 %</td><td>Move to parameter H09 and re-enter the value shown, (1.25 this example) press en t er twice. The output will go to 100%. (Don’t press OK until you are ready to leave this parameter).</td><td>Move to parameter H09 :TRIM 20ma and press en t twice.</td></tr>
<tr><td colspan="2">Read the analog output at 100% and record it as Y (19.72mA this example).</td></tr>
<tr><td colspan="2">Record the original value of H09 (1.25 this example).</td></tr>
<tr><td colspan="2">Calculate the New H08 setting using X and Y from above in Equation 1.</td></tr>
<tr><td colspan="2">Calculate the New H09 setting using X and Y from above in Equation 2.</td></tr>
<tr><td>H08 :TRIM 4ma
0.8993 %</td><td colspan="2">Store the New H08 setting (confirm the output goes to 4 mA or 0%).</td></tr>
<tr><td>H09 :Trim 20ma
2.58%</td><td colspan="2">Store the New H09 setting (confirm the output goes to 20 mA or 100%).</td></tr>
</table>

milliAmp example:
Calculate the new settings using X and Y values from above:

(Equation 1)
NEW H08 setting = (4 - X) / (Y - X) * 100 + orig. H08 setting
example: 0.89 = (4 - 3.93)/(19.72 - 3.93) * 100 + 0.45

Example: milliAmp		
	Original	New
H08	.45	.89
H09	1.25	2.58
X	3.93 mA	4.00 mA
Y	19.72 mA	20.00 mA

(Equation 2)
NEW H09 setting = (16 + X - Y)/(Y - X)*100 + current H09 setting
example: 2.58 = (16 + 3.93 - 19.72)/(19.72 - 3.93) * 100 + 1.25

0-100% example:
Calculate the new settings using X and Y values from above, where X and Y have been converted to % of span values.

Example: 0-100%		
	Original	New
H08	.45	.89
H09	1.25	2.58
X	-0.43%	0.0%
Y	98.25%	100.0%

(Equation 1)
NEW H08 setting = - X / (Y - X) * 100 + orig. H08 setting
example: 0.89 = - (-0.43)/(98.25 - (-0.43)) * 100 + 0.45

(Equation 2)
NEW H09 setting = (100 + X - Y)/(Y - X)*100 + current H09 setting
example: 2.58 = (100 + (-0.43) - 98.25)/(98.25-(-0.43)) * 100 + 1.25

4.1.15 Using the upload/download feature

The upload/download feature of the BT100/200 allows for one meter to be configured for an application and then be copied to other meters with a minimum of key strokes. **Note:** Only the parameters in menu B and C will be transferred via the upload/download procedure. The tag number will not be transferred.

To UPLOAD a configuration:

	BT200 handheld terminal	**BT100** handheld terminal
1.	Attach the handheld terminal leads to the appropriate instrument.	
2.	Using the BT100/200 set up the parameters in the YEWFLO as required, or go to step 3 if the YEWFLO is already setup.	
3.	From the menu screen, press **F4**, (**ESC**) soft key to go to the Function menu. Scroll down and select the UPLOAD TO HHT choice.	From any menu or parameter display, press the **UPLD** key.
4.	Press **ENTER** twice to begin the upload.	Press the **ENT** twice to begin the upload.
5.	Do not disconnect the leads until the UPLOAD DONE or upload COMPLETE message is displayed. **Note:** Only one configuration at a time may be stored in either the BT100 or BT200.	

To DOWNLOAD a stored configuration:

	BT200 handheld terminal	**BT100** handheld terminal
1.	Attach the handheld terminal leads to the appropriate instrument.	
2.	From the menu screen, press **F4**, (ESC**)** soft key to go to the Function menu. Scroll down and select the DOWNLOAD TO INST choice.	From any menu or parameter display, press the **DNLD** key.
	Press **ENTER** twice to begin the download.	Press **ENT** twice to begin the download.
3.	Do not disconnect the leads until the Download DONE or DOWNLOAD COMPLETE message is displayed. **Note:** This same configuration may be downloaded to as many YEWFLO meters as are required.	

Note: Only the parameters in menu B and C will be transferred via the upload/download procedure. The tag number will not be transferred.

4.2 DISASSEMBLY AND REASSEMBLY

This section describes disassembly and reassembly procedures required for maintenance and parts replacement. For replacement parts, see the parts list at the end of this manual.

Before disassembling the transmitter, turn the power off and release the pressure. Be sure to use the proper tools for disassembling and reassembling.

Caution: It is prohibited by law for the user to modify flameproof instruments. This includes adding or removing indicators. If modification is required, contact Yokogawa Industrial Automation.

4.2.1 Indicator/Totalizer removal

When servicing the amplifier, follow procedures below.

1) Turn the power off.
2) Remove the cover.
3) Completely loosen the four indicator mounting screws using a Phillips head screwdriver.
4) Disconnect the cable connector from the amplifier unit .
5) Pull out the indicator.
6) To reinstall the indicator, follow these steps in reverse order (step 5 to step 1).
7) The ribbon cable key located on top of the connector should face upward when installed.

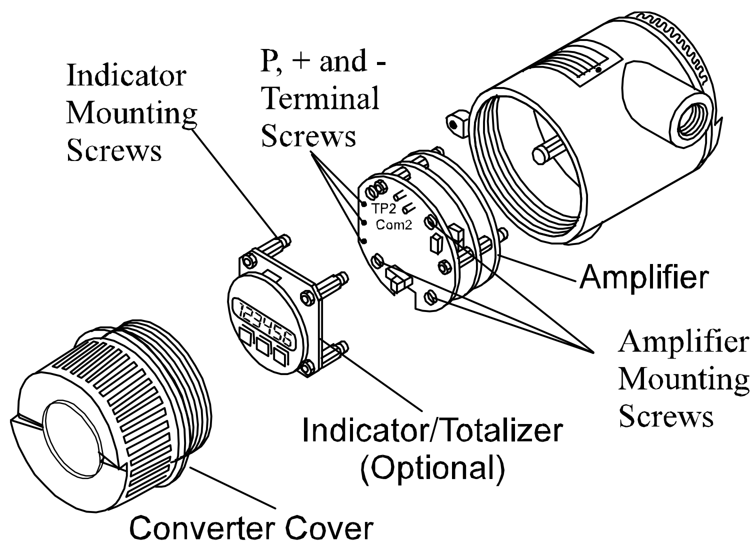

Figure 4.2.1: Removing and reinstalling the indicator

4.2.2 Amplifier replacement

Replace the amplifier as follows:

1) Turn the power off.
2) Remove the converter cover.
3) If required, remove the indicator as described in section 4.2.1.
4) Slightly loosen the three (3) terminal screws and remove the leadwires from the P, + and - terminals. Don't drop the screws.

5) Completely loosen the three amplifier mounting screws and remove the amplifier as shown in figure 4.2.1.

Caution: To avoid damaging the connector pins, do not rotate the amplifier unit.

6) When reinstalling the amplifier in the converter, match the connector pin positions with the socket then gently push the amplifier back into position. Don't push too hard or you will bend the pins.
7) Tighten the amplifier mounting screws.
8) Reconnect the leadwires to the amplifier. The sensor wires must be connected to the proper terminals for the amplifier to work correctly.
9) Set flowmeter parameters in the new amplifier.

4.3 VORTEX SHEDDER ASSEMBLY REMOVAL

Disassemble the vortex flowmeter only if the it performs abnormally. First determine the problem. Is buildup causing problems in the assembly or is it bad. You can check for buildup when you remove the shedder from the meter. If it slides out freely, buildup is not the problem. If it sticks, you should clean around the bottom socket and edges to remove residue. The following steps detail removal and reassembly procedures.

4.3.1 Removal of shedder from remote converter type

Terminal	Wire
P	Black
+	Red
-	White

1) Remove the terminal box cover.
2) Loosen the two terminal screws and disconnect the sensor wires (A & B).
3) Remove the bracket mounting bolts and remove the terminal box and bracket simultaneously. Carefully remove the terminal box by first straightening the sensor wires. To avoid damaging the wires, squeeze the wires as you slide the terminal out.
4) Remove the vortex shedder assembly mounting bolts then remove the assembly. Check for buildup around the shedder bar holes and inside the meter.
5) When reassembling the vortex shedder bar assembly, reverse the above procedure making sure the arrow on the plate is aligned with the flow on the meter body.

Color	Wire
Red	A
White	B

Table 4.3.1: Sensor Wire Color Code

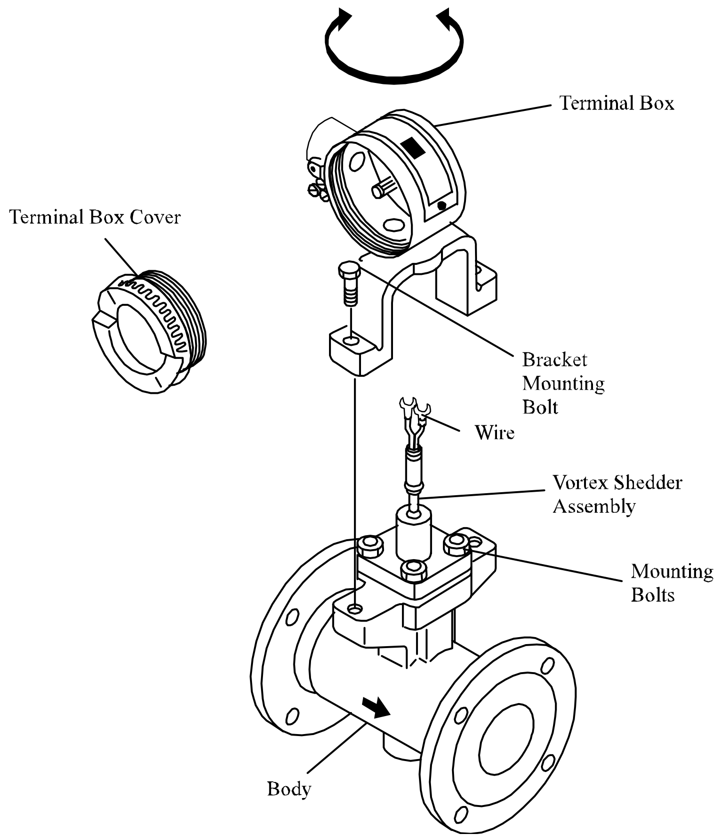

Figure 4.3.1: Disassembling and Reassembling the Vortex Shedder Assembly

Caution: When the shedder assembly is disassembled, the gasket must be replaced with a new gasket.

4.3.2 Removal of the shedder from integral type

1) Remove the converter cover.
2) Remove the amplifier. Refer to section 4.2.2 for directions.
3) Loosen the two terminal screws to disconnect sensor wires (A & B).
4) Remove the bracket mounting bolts and remove the terminal box and bracket simultaneously. Carefully remove the terminal box by first straightening the sensor wires. To avoid damaging the wires, squeeze the wires as you slide the terminal out.
5) Remove the vortex shedder assembly mounting bolts then remove the assembly. Check for buildup around the shedder bar holes and inside the meter.
6) When reassembling the vortex shedder bar assembly, reverse the above procedure making sure the arrow on the plate is aligned with the flow on the meter body.

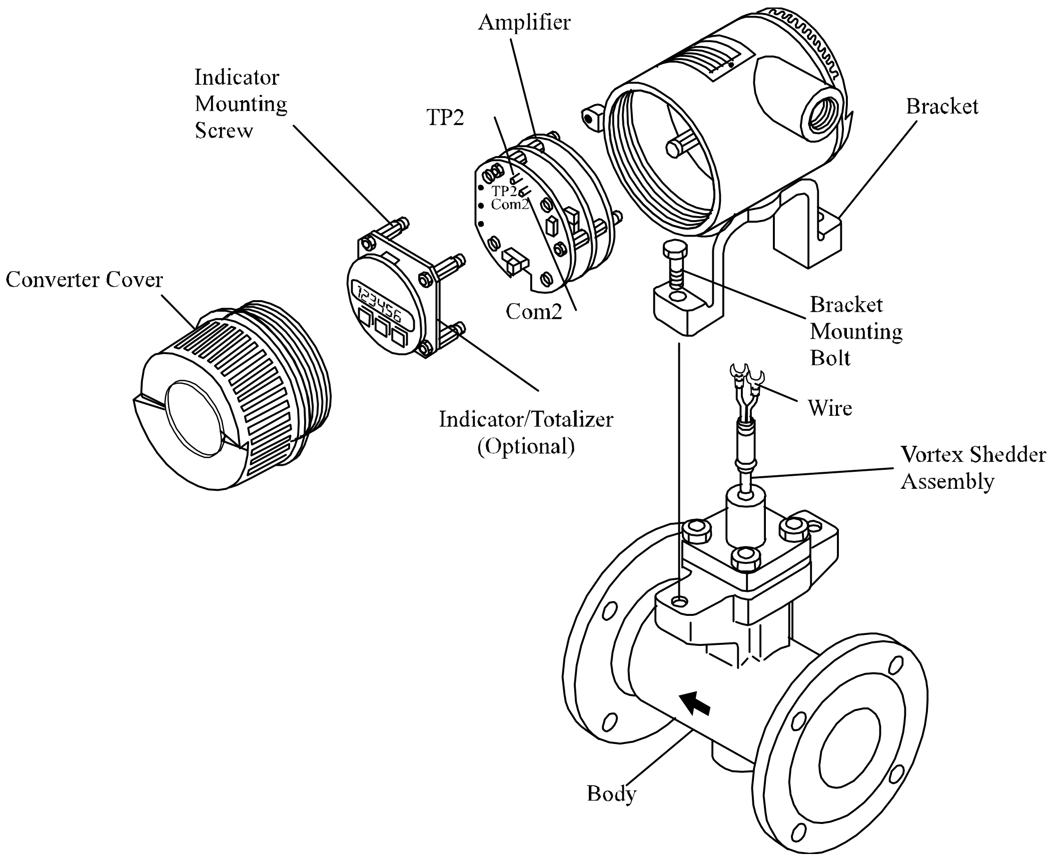

Figure 4.3.2: Disassembling and Reassembling the Vortex Shedder Assembly

4.4 REASSEMBLY CAUTIONS

1) Use a new gasket.
2) Orient the shedder bar with the wider surface upstream. Align the guide pin on the vortex shedder mounting block with the guide pin hole (1" - 4" flowmeters only). See figure 4.4.1.
3) Install the vortex shedder assembly properly.
4) Tighten all mounting bolts with a torque wrench. Use table 4.4.1 to determine the correct torque value.

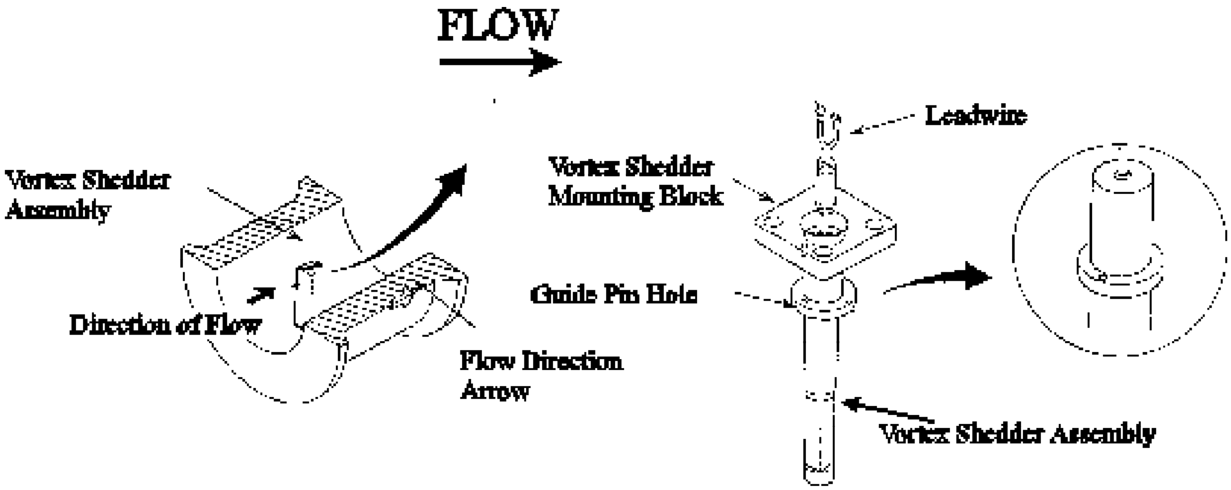

Figure 4.4.1: Vortex Shedder Bar Orientation

For high temperature assemblies (option /HPT), first tighten the bolts with a torque wrench applying the A value. Next, completely loosen all the bolts and retighten with a torque wrench this time using the B value.

5) Insert the sensor wires through the bottom hole of the terminal box. Slowly lower the terminal box until the bracket touches the flowmeter shoulder. Be sure to keep the sensor wires vertical while lowering the terminal box.
6) After assembly, confirm that there is no leakage.

4.4.1 YEWFLO shedder bolt torque procedure

Table 4.4.1 summarizes the torque values which should be used when reinstalling a shedder bar in any YEWFLO Vortex meter. When reading this table, please keep the following in mind:

1) Use the TEFLON COATED GASKET table for all meters with teflon-coated gaskets.
2) Use the SILVER PLATED GASKET tables for all meters with silver-coated gaskets regardless of whether they have a high-temperature sensor.
3) For meters with four bolts, tighten alternate bolts to produce an even compression of the gasket.
4) Enter the appropriate table using the meter size. Tighten all bolts to the value shown in the first column. When finished, tighten all bolts to the value shown in the second column. Continue this procedure until all bolts are tightened to the highest torque value.
5) For meters with silver-coated gaskets, begin by using the table labeled 1st round. When complete, unscrew all attachment bolts until the gasket compression plate is loose. Retighten all bolts using the values shown in the table marked 2nd round. Notice that some torque values are less for the second tightening sequence than for the first.

BOLT TORQUE CHART

GREEN TEFLON COATED GASKET TORQUE

Size	1st	2nd	3rd	4th	5th
YF101	40 in-lb	70 in-lb	100 in-lb	140 in-lb	
YF102,104	25 in-lb	60 in-lb	90 in-lb	105 in-lb	
YF105	10 ft-lb	15 ft-lb	22 ft-lb	29 ft-lb	
YF108	10 ft-lb	22 ft-lb	37 ft-lb	43.5 ft-lb	
YF110	10 ft-lb	22 ft-lb	43.5 ft-lb	58 ft-lb	72.5 ft-lb
YF115	10 ft-lb	15 ft-lb	29 ft-lb	36.5 ft-lb	
YF120	10 ft-lb	22 ft-lb	37 ft-lb	51 ft-lb	

SILVER PLATED GASKET 1ST ROUND

Size	1st	2nd	3rd	4th	5th
YF102,104	30 in-lb	60 in-lb	90 in-lb	120 in-lb	152 in-lb
YF105	10 ft-lb	22 ft-lb	37 ft-lb	43.5 ft-lb	
YF108	10 ft-lb	22 ft-lb	43.5 ft-lb	58.5 ft-lb	72.5 ft-lb
YF110	20 ft-lb	40 ft-lb	60 ft-lb	80 ft-lb	101 ft-lb
YF115	10 ft-lb	15 ft-lb	29 ft-lb	36.5 ft-lb	51 ft-lb
YF120	10 ft-lb	22 ft-lb	37 ft-lb	51 ft-lb	72 ft-lb

SILVER PLATED GASKET 2ND ROUND

Size	1st	2nd	3rd	4th	5th
YF102,104	30 in-lb	60 in-lb	90 in-lb	105 in-lb	
YF105	10 ft-lb	15 ft-lb	22 ft-lb	29 ft-lb	
YF108	10 ft-lb	22 ft-lb	37 ft-lb	43.5 ft-lb	
YF110	20 ft-lb	22 ft-lb	43 ft-lb	58 ft-lb	72.5 ft-lb
YF115	10 ft-lb	15 ft-lb	29 ft-lb	36.5 ft-lb	
YF120	10 ft-lb	22 ft-lb	37 ft-lb	51 ft-lb	

Table 4.4.1

4.5 YEWFLO Style "E" Amplifier Calibration Procedure

Before calibrating the YEWFLO style E you will need to have the following tools on hand:

Item	Recommended Instruments	Remarks
Power Supply	24 VDC ±10% (Ripple ≤ ±50mV)	
Load Resistance	(250 ohm) ±0.005%	4-20 mA DC version only
Voltmeter	Model 2506A digital multimeter (accuracy ±0.05%)	4-20 mA DC version only
Oscilloscope	Optional	Optional
BRAIN terminal	BT100 or BT200 handheld terminal	For parameter setting

The YEWFLO Style "E" amplifier is microprocessor-based and in normal operation the span vs. output relationship is checked automatically through the microprocessor's calculations. If it is necessary to prove the span/output relationship or generally check the correct operation of the amplifier, the following procedure can be followed. The procedure consists of two sections. Section 4.5.1 may be performed independently, but Section 4.5.2 and/or 4.5.3 should be performed only after Section 4.5.1 has been completed.

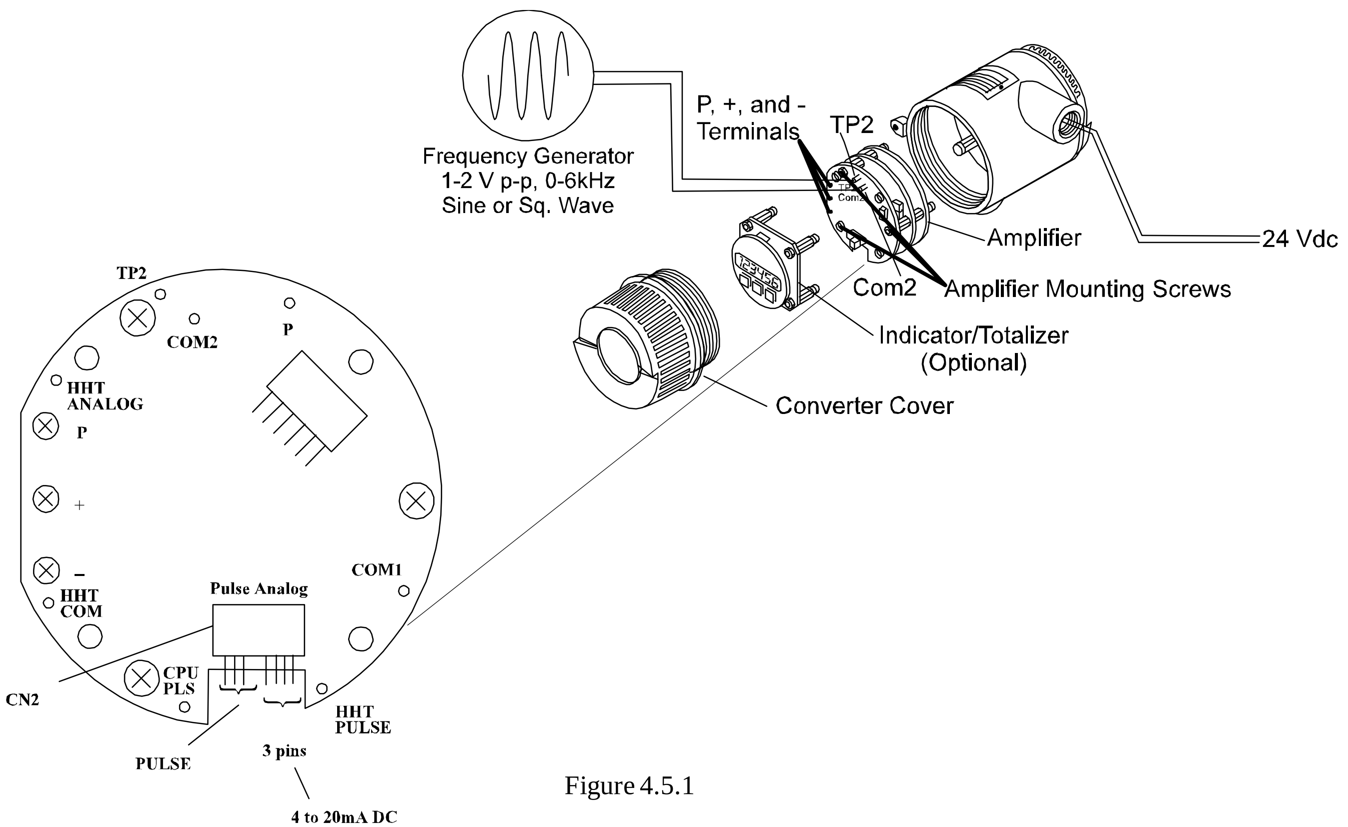

Figure 4.5.1

If the amplifier is checked in the instrument shop, be sure the amplifier case is well grounded. On remote amplifiers, besides grounding the case be sure to short terminals A, B, and C and ground them to the case. If checking an amplifier on a meter in-line, be sure the amplifier is well grounded and a no-flow condition exists.

Connect the amplifier as shown in 4.5.1. Apply power for at least five minutes before testing.

Before beginning, check to be sure that all parameter settings are as specified in the programming sheet which was included with the flowmeter instructions. If there is any discrepancy, correct the program values. If the amplifier has been reconfigured to accommodate new process conditions or the programming sheet is not available, it will be necessary to generate a new sheet by running the YEWFLO sizing program. Contact your Yokogawa Industrial Automation representative for a copy of the sizing program.

Note: For the remote amplifier, terminals A, B & C should be shorted together; otherwise, electrical noise may interfere.

4.5.1 General amplifier check-out

a. Access parameter H06 (NOISE JUDGE) and set to “NOT ACTIVE”.

b. Access parameter G02 (SPAN FREQUENCY) and record this value. Attach a calibrated frequency generator to test points TP2 and COM2 and inject the same frequency as read in parameter G02.

c. Access parameter G01 (FREQUENCY) and confirm that this value agrees with the frequency in Step b above to within ±0.1%. Agreement of these two values confirms the general internal operation of the amplifier. Any discrepancy in these two values indicates a problem with the amplifier which may require amplifier replacement. Contact the Yokogawa Industrial Automation Service Department for assistance at 1-800-524-7378.

d. If you wish to stop here, disconnect the frequency generator, return parameter H06 to “ACTIVE”. Otherwise, leave the frequency generator connected and parameters H06 and any correction functions deactivated and proceed to the next section to confirm amplifier calibration.

4.5.2 Analog output test

Before beginning this section, perform the amplifier checkout procedure, steps 4.5.1a - d above.

a. Check the PULSE/ANALOG jumpers on the front of the amplifier to be sure they are in the correct position. Access (analog) parameter B02 (OUTPUT) and confirm the setting agrees with the jumper position.

b. With the frequency generator connected and injecting the frequency per Step 4.5.1b measure the current being produced by the amplifier. The output should be 20 mA, ±.02 mA.

c. Remove the frequency generator and replace it with a shorting jumper and measure the output. The output should be 4 mA, ±.02 mA.

d. If there is a discrepancy in the outputs measured in steps b and c, contact the Yokogawa Industrial Automation Service Department for assistance at 1-800-524-7378. Otherwise, remove the jumper, return parameter H06 to “ACTIVE”. Analog testing is complete.

4.5.3 Pulse output test

Before beginning this section, perform the amplifier checkout procedure, steps a-d above.

a. Check the PULSE/ANALOG jumpers on the front of the amplifier to be sure they are in the correct position (pulse). Access parameter B02 (OUTPUT) and confirm the setting agrees with the jumper position. Access parameter C02 (PULSE RATE) and set it to "UNSC*1".

b. With the frequency generator connected and injecting the frequency per Step 4.5.1b, connect a frequency counter across the "-" and "P" output screw terminals.

c. Check to be sure the frequency counter reads the frequency specified in Step 4.5.1b above (±0.1%).

d. Remove the frequency generator and replace it with a jumper. Check to be sure the frequency counter reads 0 Hz.

e. If there is a discrepancy in the outputs measured in Steps c and d, contact the Yokogawa Industrial Automation Service Department for assistance at 1-800-524-7378. Otherwise, remove the jumper, return parameter H06 to "ACTIVE", and return parameter C02 to your required pulse rate setting. Testing is complete.

4.2 DISASSEMBLY AND REASSEMBLY

This section describes disassembly and reassembly procedures required for maintenance and parts replacement. For replacement parts, see the parts list at the end of this manual.

Before disassembling the transmitter, turn the power off and release the pressure. Be sure to use the proper tools for disassembling and reassembling.

Caution: It is prohibited by law for the user to modify flameproof instruments. This includes adding or removing indicators. If modification is required, contact Yokogawa Industrial Automation.

4.2.1 Indicator/Totalizer removal

When servicing the amplifier, follow procedures below.

1) Turn the power off.
2) Remove the cover.
3) Completely loosen the four indicator mounting screws using a Phillips head screwdriver.
4) Disconnect the cable connector from the amplifier unit .
5) Pull out the indicator.
6) To reinstall the indicator, follow these steps in reverse order (step 5 to step 1).
7) The ribbon cable key located on top of the connector should face upward when installed.

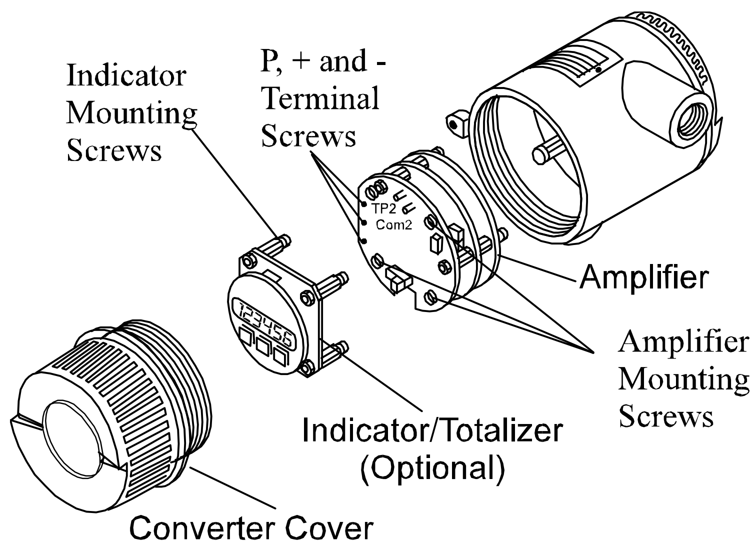

Figure 4.2.1: Removing and reinstalling the indicator

4.2.2 Amplifier replacement

Replace the amplifier as follows:

1) Turn the power off.
2) Remove the converter cover.
3) If required, remove the indicator as described in section 4.2.1.
4) Slightly loosen the three (3) terminal screws and remove the leadwires from the P, + and - terminals. Don't drop the screws.

5) Completely loosen the three amplifier mounting screws and remove the amplifier as shown in figure 4.2.1.

Caution: To avoid damaging the connector pins, do not rotate the amplifier unit.

6) When reinstalling the amplifier in the converter, match the connector pin positions with the socket then gently push the amplifier back into position. Don't push too hard or you will bend the pins.
7) Tighten the amplifier mounting screws.
8) Reconnect the leadwires to the amplifier. The sensor wires must be connected to the proper terminals for the amplifier to work correctly.
9) Set flowmeter parameters in the new amplifier.

4.3 VORTEX SHEDDER ASSEMBLY REMOVAL

Disassemble the vortex flowmeter only if the it performs abnormally. First determine the problem. Is buildup causing problems in the assembly or is it bad. You can check for buildup when you remove the shedder from the meter. If it slides out freely, buildup is not the problem. If it sticks, you should clean around the bottom socket and edges to remove residue. The following steps detail removal and reassembly procedures.

4.3.1 Removal of shedder from remote converter type

Terminal	Wire
P	Black
+	Red
-	White

1) Remove the terminal box cover.
2) Loosen the two terminal screws and disconnect the sensor wires (A & B).
3) Remove the bracket mounting bolts and remove the terminal box and bracket simultaneously. Carefully remove the terminal box by first straightening the sensor wires. To avoid damaging the wires, squeeze the wires as you slide the terminal out.
4) Remove the vortex shedder assembly mounting bolts then remove the assembly. Check for buildup around the shedder bar holes and inside the meter.
5) When reassembling the vortex shedder bar assembly, reverse the above procedure making sure the arrow on the plate is aligned with the flow on the meter body.

Color	Wire
Red	A
White	B

Table 4.3.1: Sensor Wire Color Code

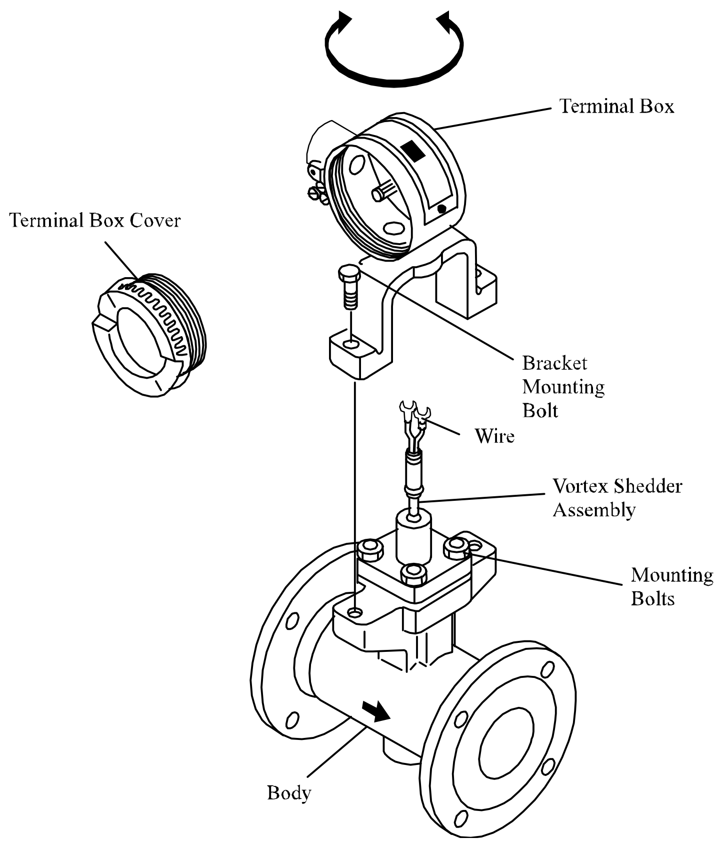

Figure 4.3.1: Disassembling and Reassembling the Vortex Shedder Assembly

Caution: When the shedder assembly is disassembled, the gasket must be replaced with a new gasket.

4.3.2 Removal of the shedder from integral type

1) Remove the converter cover.
2) Remove the amplifier. Refer to section 4.2.2 for directions.
3) Loosen the two terminal screws to disconnect sensor wires (A & B).
4) Remove the bracket mounting bolts and remove the terminal box and bracket simultaneously. Carefully remove the terminal box by first straightening the sensor wires. To avoid damaging the wires, squeeze the wires as you slide the terminal out.
5) Remove the vortex shedder assembly mounting bolts then remove the assembly. Check for buildup around the shedder bar holes and inside the meter.
6) When reassembling the vortex shedder bar assembly, reverse the above procedure making sure the arrow on the plate is aligned with the flow on the meter body.

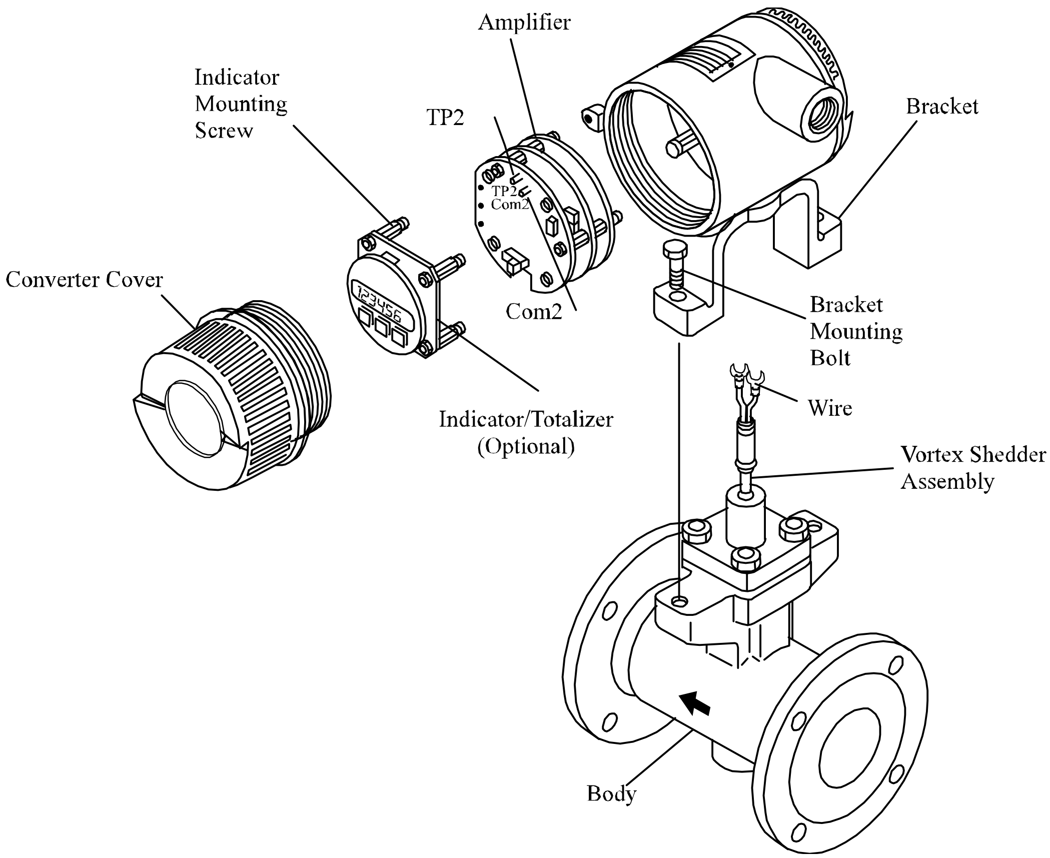

Figure 4.3.2: Disassembling and Reassembling the Vortex Shedder Assembly

4.4 Reassembly Cautions

1) Use a new gasket.
2) Orient the shedder bar with the wider surface upstream. Align the guide pin on the vortex shedder mounting block with the guide pin hole (1" - 4" flowmeters only). See figure 4.4.1.
3) Install the vortex shedder assembly properly.
4) Tighten all mounting bolts with a torque wrench. Use table 4.4.1 to determine the correct torque value.

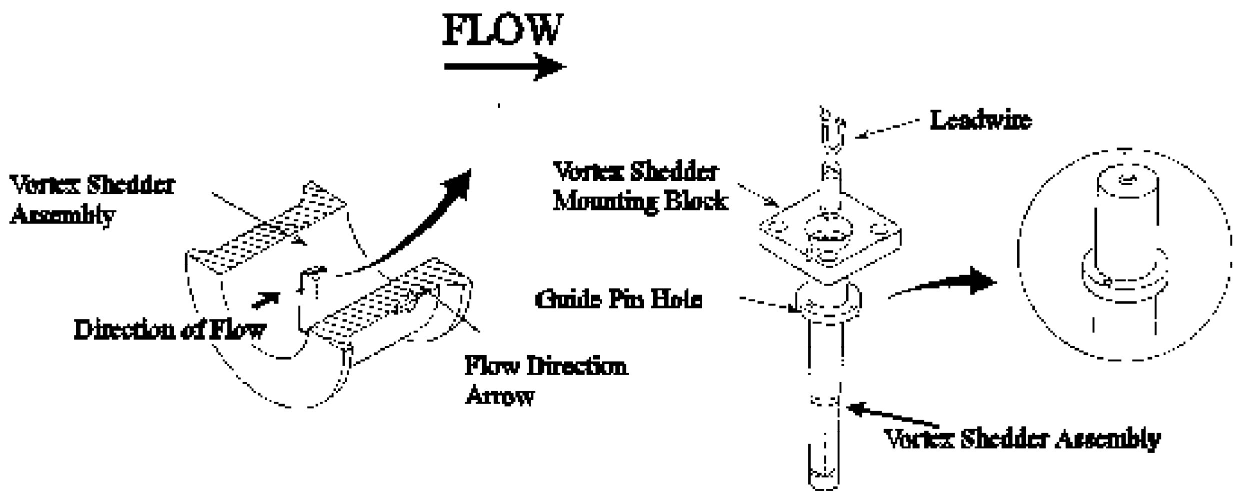

Figure 4.4.1: Vortex Shedder Bar Orientation

For high temperature assemblies (option /HPT), first tighten the bolts with a torque wrench applying the A value. Next, completely loosen all the bolts and retighten with a torque wrench this time using the B value.

5) Insert the sensor wires through the bottom hole of the terminal box. Slowly lower the terminal box until the bracket touches the flowmeter shoulder. Be sure to keep the sensor wires vertical while lowering the terminal box.
6) After assembly, confirm that there is no leakage.

4.4.1 YEWFLO shedder bolt torque procedure

Table 4.4.1 summarizes the torque values which should be used when reinstalling a shedder bar in any YEWFLO Vortex meter. When reading this table, please keep the following in mind:

1) Use the TEFLON COATED GASKET table for all meters with teflon-coated gaskets.
2) Use the SILVER PLATED GASKET tables for all meters with silver-coated gaskets regardless of whether they have a high-temperature sensor.
3) For meters with four bolts, tighten alternate bolts to produce an even compression of the gasket.
4) Enter the appropriate table using the meter size. Tighten all bolts to the value shown in the first column. When finished, tighten all bolts to the value shown in the second column. Continue this procedure until all bolts are tightened to the highest torque value.
5) For meters with silver-coated gaskets, begin by using the table labeled 1st round. When complete, unscrew all attachment bolts until the gasket compression plate is loose. Retighten all bolts using the values shown in the table marked 2nd round. Notice that some torque values are less for the second tightening sequence than for the first.

BOLT TORQUE CHART

GREEN TEFLON COATED GASKET TORQUE

Size	1st	2nd	3rd	4th	5th
YF101	40 in-lb	70 in-lb	100 in-lb	140 in-lb	
YF102,104	25 in-lb	60 in-lb	90 in-lb	105 in-lb	
YF105	10 ft-lb	15 ft-lb	22 ft-lb	29 ft-lb	
YF108	10 ft-lb	22 ft-lb	37 ft-lb	43.5 ft-lb	
YF110	10 ft-lb	22 ft-lb	43.5 ft-lb	58 ft-lb	72.5 ft-lb
YF115	10 ft-lb	15 ft-lb	29 ft-lb	36.5 ft-lb	
YF120	10 ft-lb	22 ft-lb	37 ft-lb	51 ft-lb	

SILVER PLATED GASKET 1ST ROUND

Size	1st	2nd	3rd	4th	5th
YF102,104	30 in-lb	60 in-lb	90 in-lb	120 in-lb	152 in-lb
YF105	10 ft-lb	22 ft-lb	37 ft-lb	43.5 ft-lb	
YF108	10 ft-lb	22 ft-lb	43.5 ft-lb	58.5 ft-lb	72.5 ft-lb
YF110	20 ft-lb	40 ft-lb	60 ft-lb	80 ft-lb	101 ft-lb
YF115	10 ft-lb	15 ft-lb	29 ft-lb	36.5 ft-lb	51 ft-lb
YF120	10 ft-lb	22 ft-lb	37 ft-lb	51 ft-lb	72 ft-lb

SILVER PLATED GASKET 2ND ROUND

Size	1st	2nd	3rd	4th	5th
YF102,104	30 in-lb	60 in-lb	90 in-lb	105 in-lb	
YF105	10 ft-lb	15 ft-lb	22 ft-lb	29 ft-lb	
YF108	10 ft-lb	22 ft-lb	37 ft-lb	43.5 ft-lb	
YF110	20 ft-lb	22 ft-lb	43 ft-lb	58 ft-lb	72.5 ft-lb
YF115	10 ft-lb	15 ft-lb	29 ft-lb	36.5 ft-lb	
YF120	10 ft-lb	22 ft-lb	37 ft-lb	51 ft-lb	

Table 4.4.1

4.5 YEWFLO STYLE "E" AMPLIFIER CALIBRATION PROCEDURE

Before calibrating the YEWFLO style E you will need to have the following tools on hand:

Item	Recommended Instruments	Remarks
Power Supply	24 VDC ±10% (Ripple ≤ ±50mV)	
Load Resistance	(250 ohm) ±0.005%	4-20 mA DC version only
Voltmeter	Model 2506A digital multimeter (accuracy ±0.05%)	4-20 mA DC version only
Oscilloscope	Optional	Optional
BRAIN terminal	BT100 or BT200 handheld terminal	For parameter setting

The YEWFLO Style "E" amplifier is microprocessor-based and in normal operation the span vs. output relationship is checked automatically through the microprocessor's calculations. If it is necessary to prove the span/output relationship or generally check the correct operation of the amplifier, the following procedure can be followed. The procedure consists of two sections. Section 4.5.1 may be performed independently, but Section 4.5.2 and/or 4.5.3 should be performed only after Section 4.5.1 has been completed.

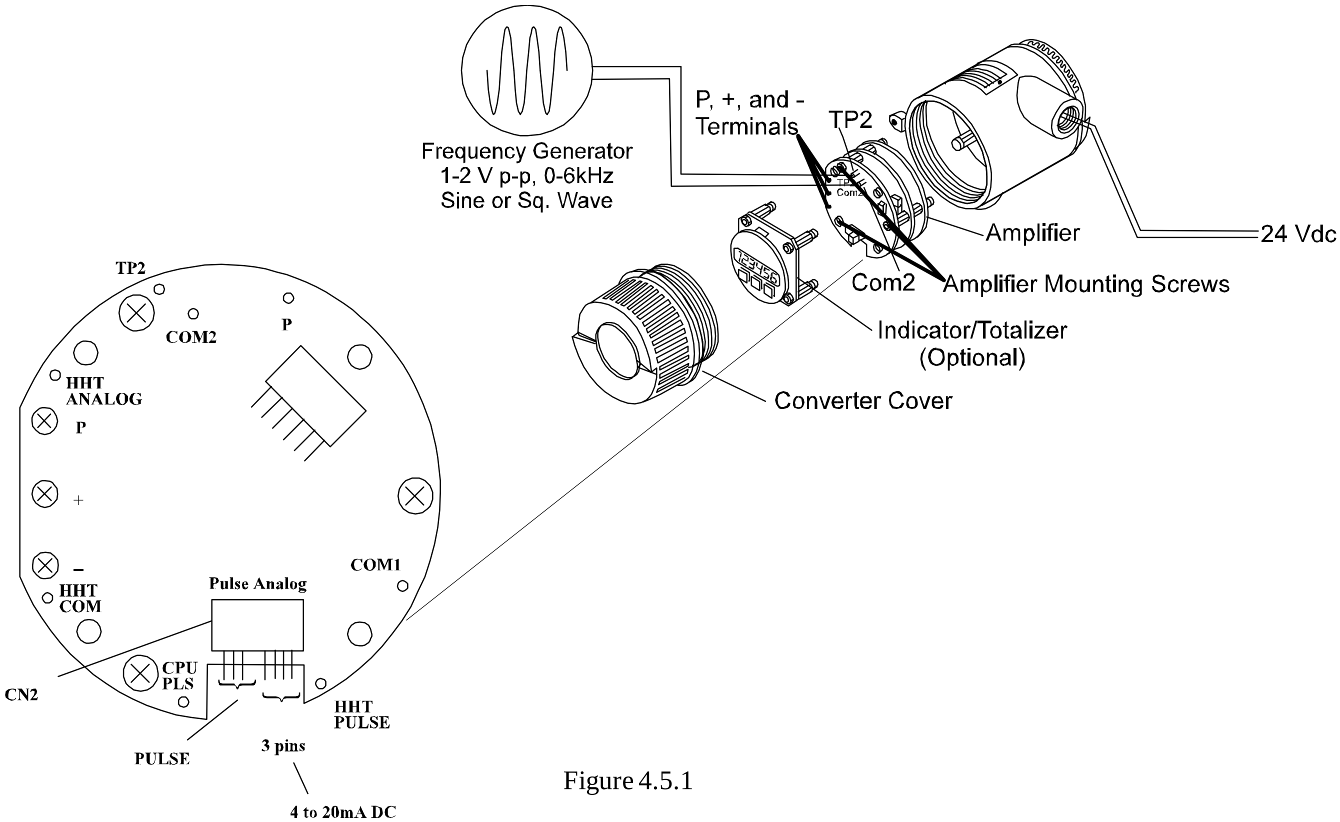

Figure 4.5.1

If the amplifier is checked in the instrument shop, be sure the amplifier case is well grounded. On remote amplifiers, besides grounding the case be sure to short terminals A, B, and C and ground them to the case. If checking an amplifier on a meter in-line, be sure the amplifier is well grounded and a no-flow condition exists.

Connect the amplifier as shown in 4.5.1. Apply power for at least five minutes before testing.

Before beginning, check to be sure that all parameter settings are as specified in the programming sheet which was included with the flowmeter instructions. If there is any discrepancy, correct the program values. If the amplifier has been reconfigured to accommodate new process conditions or the programming sheet is not available, it will be necessary to generate a new sheet by running the YEWFLO sizing program. Contact your Yokogawa Industrial Automation representative for a copy of the sizing program.

Note: For the remote amplifier, terminals A, B & C should be shorted together; otherwise, electrical noise may interfere.

4.5.1 General amplifier check-out

a. Access parameter H06 (NOISE JUDGE) and set to "NOT ACTIVE".

b. Access parameter G02 (SPAN FREQUENCY) and record this value. Attach a calibrated frequency generator to test points TP2 and COM2 and inject the same frequency as read in parameter G02.

c. Access parameter G01 (FREQUENCY) and confirm that this value agrees with the frequency in Step b above to within ±0.1%. Agreement of these two values confirms the general internal operation of the amplifier. Any discrepancy in these two values indicates a problem with the amplifier which may require amplifier replacement. Contact the Yokogawa Industrial Automation Service Department for assistance at 1-800-524-7378.

d. If you wish to stop here, disconnect the frequency generator, return parameter H06 to "ACTIVE". Otherwise, leave the frequency generator connected and parameters H06 and any correction functions deactivated and proceed to the next section to confirm amplifier calibration.

4.5.2 Analog output test

Before beginning this section, perform the amplifier checkout procedure, steps 4.5.1a - d above.

a. Check the PULSE/ANALOG jumpers on the front of the amplifier to be sure they are in the correct position. Access (analog) parameter B02 (OUTPUT) and confirm the setting agrees with the jumper position.

b. With the frequency generator connected and injecting the frequency per Step 4.5.1b measure the current being produced by the amplifier. The output should be 20 mA, ±.02 mA.

c. Remove the frequency generator and replace it with a shorting jumper and measure the output. The output should be 4 mA, ±.02 mA.

d. If there is a discrepancy in the outputs measured in steps b and c, contact the Yokogawa Industrial Automation Service Department for assistance at 1-800-524-7378. Otherwise, remove the jumper, return parameter H06 to "ACTIVE". Analog testing is complete.

4.5.3 Pulse output test

Before beginning this section, perform the amplifier checkout procedure, steps a-d above.

a. Check the PULSE/ANALOG jumpers on the front of the amplifier to be sure they are in the correct position (pulse). Access parameter B02 (OUTPUT) and confirm the setting agrees with the jumper position. Access parameter C02 (PULSE RATE) and set it to “UNSC*1”.

b. With the frequency generator connected and injecting the frequency per Step 4.5.1b, connect a frequency counter across the “-” and “P” output screw terminals.

c. Check to be sure the frequency counter reads the frequency specified in Step 4.5.1b above (±0.1%).

d. Remove the frequency generator and replace it with a jumper. Check to be sure the frequency counter reads 0 Hz.

e. If there is a discrepancy in the outputs measured in Steps c and d, contact the Yokogawa Industrial Automation Service Department for assistance at 1-800-524-7378. Otherwise, remove the jumper, return parameter H06 to “ACTIVE”, and return parameter C02 to your required pulse rate setting. Testing is complete.

V. PARAMETER SETTING/CONFIGURATION

5.1 NOTES ON THE TBL OPTIONAL DIGITAL DISPLAY

The TBL digital display may be used to set most of the parameters required to configure the YEWFLO. In the Parameter list each item is marked to indicate whether that parameter can be set or not. Due to the limited number of digits available in the TBL display, the full item identification is not possible. Tables 5.1.1 and 5.1.2 describe the item numbers and their function on the TBL display.

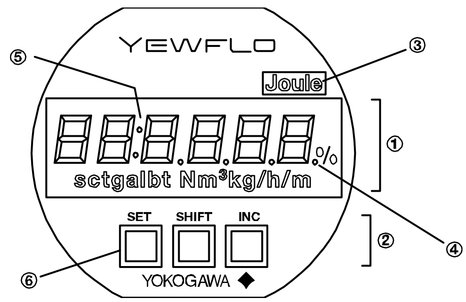

Figure 5.1.1: Integral Indicator/Totalizer Display

Item	Description
①	Display section: Displays data, units, parameter setting item numbers, and parameters.
	Setting section:
	Attach unit labels if those other than displayed units are to be used. Sets parameter item numbers and parameter data using **SET**, **SHIFT**, and **INC** parameter setting keys.
	Decimal point
	A symbol for delimiting a parameter setting item number and a parameter data
	Setting key

Table 5.1.1: Mode Name List

Display Mode Number	Name	Contents
0	%; display mode	Instantaneous flow rate is displayed as 0.0 to 110.0%.
1	Display in engineering unit mode	Instantaneous flow as an engineering unit is displayed using 0 to 32000.
2	Display in totalized flow mode	Totalized flow is displayed as 0 to 999999 without indicating the decimal point.
3	Display alternates between % flow rate and totalized flow mode	Instantaneous flow rate (%) and totalized flow (engineering unit) are alternately displayed.
4	Display alternates between flow rate in engineering units and totalized flow mode	Instantaneous flow rate (engineering unit) and totalized flow rate (engineering unit) are alternately displayed.
5	Display alternates between instantaneous flow rates in engineering unit and %	Instantaneous flow rates are alternately displayed as engineering units and percentage (%).

Table 5.1.2: Description of display

As shown on the BT100/BT200	As shown on TBL TBL indicator/ totalizer display
B02	2
B03	3
B10	10
B11	11
B52	52
B53	53
C01	C1
C02	C2
C09	C9
D01	d1
D02	d2
D03	d3
D05	d5
D06	d6
E01	E1
E02	E2

As shown on the BT100/BT200	As shown on TBL TBL indicator/ totalizer display
E03	E3
F01	F1
F02	F2
G01	G1
G02	G2
G03	G3
G04	G4
G05	G5
G06	G6
H01	H1
H02	H2
H03	H3
H04	H4
H05	H5
H06	H6
H07	H7

5.1.1 Display contents in display section

Available modes include normal, setting and alarm number display. Each is described in detail in table 5.1.3.

No.	Mode (status) name	Key operation	Display contents
1	Normal mode	---	A mode in which instantaneous flow rates or totalized values are displayed. Display content is usually selected either in display content selection mode or by setting parameters via BRAIN™ communication.
2	Setting mode	SET	In this mode, parameter contents are confirmed or data is updated using the setting section. The mode is changed to this mode when **SET** is pressed in normal mode.
3	Alarm number display mode	---	This mode is overlapped when an alarm is occurring in normal mode. The alarm number presentation to indicate alarm contents (about 2 secs) and the normal data display (about 4 secs) are repeated alternatively.

Table 5.1.4: Display Mode Number List

•**Normal Mode**

The normal mode will display the instantaneous flow rate or totalized flow. The six available display modes are shown in Table 5.1.1.

To access the Setting mode press the **SET** key which transfers to the “setting mode” status. The left two digits indicate the parameter item number and the four digits to the right of the “ : “ indicate the parameter data content.

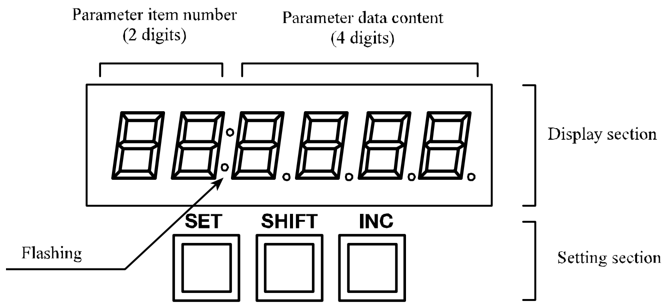

Figure 5.1.2: Integral Indicator/Totalizer Setting and Display Sections

Once in the "SET" mode change the parameter item number using the **INC** key and move the flashing digits using the **SHIFT** key. Press the **set** key to move to the setting mode. Change the parameter data value and the decimal point position using the **Inc** key and shift the flashing digit using the **SHIFT** key. Once the parameter has been set correctly, press the **set** key once. The entire display will then flash. Confirm the setting by pressing the **set** again. The flashing will stop. The parameter is then set. When all parameter settings have been correctly set, press **set** and **SHIFT** keys simultaneously. The display is now returned to the normal mode. If the setting has been done outside the proper operating parameters, alarm is displayed.

•Setting Mode

The display mode can be changed using either the BT100 using parameter "E02: Disp Select" or the integral indicator/totalizer (TBL) by using the E2 parameter item.

Caution: While in the setting mode using the TBL, do not access the amplifier using the BT100, Centum or XL distributed control system with BRAIN™ communications.

•Alarm Number Display Mode

When an alarm occurs, alarm number display and normal display are alternately displayed on the TBL to indicate an alarm condition exists, provided the TBL is in the normal mode.

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Sequence	Key Operation	Display	Description
0		100.00%	Normal mode Example of totalized value
1	**SET** Press **SET** key	2 :_ _0 0 ¤Flashing display position is changeable changeable	Setting mode •Press **SET** key to enter setting mode. •Parameter item number can be changed.
2	**INC** **INC** **INC**	¤[C1] is displayed. ¤[d1] is displayed. 1 :_ _0 0	•Press **INC** key •Press **INC** key •Press INC key
3	**SHIFT** **INC**	E :_ _0 0 E :_ _0 0 ¤Display contents are different from which values were set.	•When **SHIFT** key is pressed, flashing display position moves to E. • **INC** key is pressed, 1 changes to 2.
4	**SET** **INC**	E :_ _0 0	•Next, press **SET** key, flashing display position moves to far right. ¤Parameter contents can be set.
5	**SET** **SET**	E 2 :_ _0 0 2 :_ _0 0	•Press **SET** key once display is flashing. •Press **SET** key once more to move flashing display position to the far left.
6	**SET** and **SHIFT**	123456 kg	Mode returns to normal.

Table 5.1.5: Display mode change sequence

VI. ERROR CODES

6.1 Error Code Listing

Error No.	Diagnostic Message	Error definition and Probability Cause	Effect on Output: Current Output	Effect on Output: Pulse Output	Effect on Indication via local Digital Display: Rate in % Output	Effect on Indication via local Digital Display: Rate in Engineering Units	Effect on Indication via local Digital Display: Totalizer	Corrective Action
1	Over Output	This error signifies that the flow exceeds the meter span by over 110%.	Output driven to a fixed 110%.	Normal Operation	Indication is driven to a fixed 110% of the span.	Normal Operation	Normal Operation	Respan the meter or correct the overrange condition.
2	Span Set error	A span setting error indicates that the span velocity limits have been exceeded. (32 ft/sec for liquids and 262 ft/sec for gas). Sensor may be damaged. Contact Yokogawa Industrial Automation service department for analysis.	Output may be non-linear.	Output may be non-linear.	Output may be non-linear.	Output may be non-linear.	Output may be non-linear.	Correct the span setting in parameter B51 and B52 to meet the velocity limitations of the meter.
3	NJ circuit error	Noise discrimination circuit is not functioning properly.	Normal Operation	Normal Operation	Normal Operation	Normal Operation	Normal Operation	Amplifier replacement required. Contact Yokogawa Industrial Automation service dept.
4	Pulse Out error	The pulse output span has exceeded 6K Hertz.	Normal Operation	Output is limited to 6K Hertz.	Normal Operation	Normal Operation	Normal Operation	Check parameter settings, in particular C02.
5	EE Prom error	EE prom is not functioning correctly.	Output is fixed at 1.25%.	No output	Output is fixed at -1.25%.	Output is fixed at 0.0%.	No output	Amplifier replacement required. Contact Yokogawa Industrial Automation service dept.
---	CPU error	The CPU has failed and the meter is not functioning. The display and self-diagnostics are completely inoperable.	Output is fixed at 1.25%.	No output	No output	No output	No output	Amplifier replacement required. Contact Yokogawa Industrial Automation service dept.

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6.2 OPERATING PROCEDURES

The Vortex shedding flowmeter is a frequency measuring device. The frequency is generated as described in the ‘Principle of Operation’ section, and is linear and proportional to flow velocity. The electronics convert this frequency into a flow rate signal suitable for your process, providing either an Analog 4-20 mA or powered voltage pulse output.

This troubleshooting section is designed to familiarize you with the electronic circuit, and internal software operation.

Operating range:
Before proceeding, double check your process conditions and insure that the desired flow rate is within the operating range, greater than minimum (Qmin) and less than maximum (Qmax). Please reference the YEWFLO sizing program, or refer to section 1.4 Basic Sizing.

Electronic Circuit Operation:
If the operating flow rate is above Qmin, the vortex shedder with a piezoelectric sensor assembly should generate a frequency signal proportional to flow rate.

The following circuit configuration is a simplified block diagram of the actual circuit. Some details are left out for clarity.

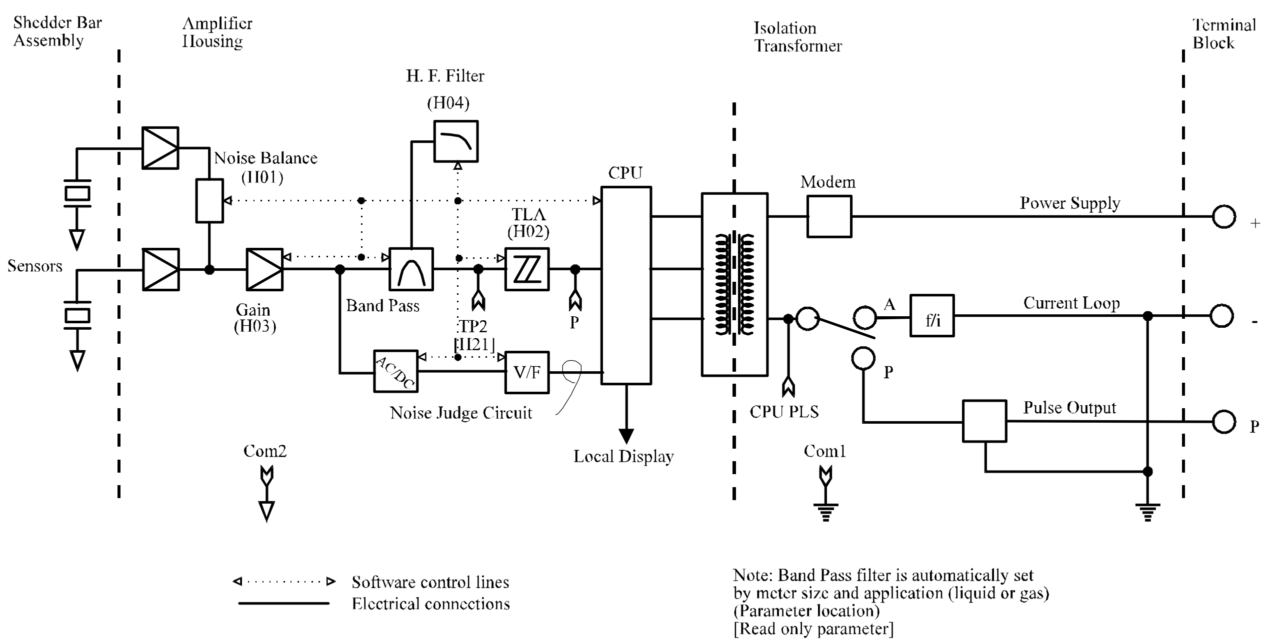


Figure 6.2.1: Circuit Configuration

1. **Vortex Shedder (Sensor):** The shedder bar assembly (sensor) may be integrally mounted to the amplifier or remotely connected via a special signal cable. In any case, the piezoelectric crystal signal is amplified by a high impedance preamplifier circuit.
2. **Noise Balance:** The Noise Balance function maximizes the signal to noise (S/N) ratio by mixing the two crystal input signals. One crystal measures primarily flow frequency. The other crystal measures primarily frequencies due to noise. This parameter is factory set, but on occasion may need to be adjusted after installation. By properly balancing these signals in a one time setup, the S/N ratio is maximized.
3. **Gain:** The balanced signal is then amplified by the gain stage. The gain is automatically set when meter size and application (liquid or gas) are selected. This parameter should not normally be adjusted, unless directed by the factory.
4. After the gain stage the signal is split. One signal is used to measure frequency, proportional to flow velocity. The other signal is used to measure amplitude, proportional to fluid momentum, for Noise Judge calculations.
5. **Band Pass and High Frequency (H.F.) Filter:** The frequency signal is filtered by both a Band Pass filter and a High Frequency Filter. Filter settings are automatically set when meter size and application are selected.
6. The output of the filter stage may be measured by a voltmeter or viewed with an Oscilloscope at the TP2 and Com2 test points.
7. **Trigger Level Adjustment (TLA):** The filtered waveform is then converted to a square wave by comparing its amplitude to the Trigger Level Adjustment (TLA) setting. The resulting square wave may be viewed at the P and Com2 test points. The frequency of this square wave is directly proportional to velocity.
8. The flow rate frequency is then input to the CPU for further calculation.
9. Noise Judge circuit: Simultaneous to steps 5 through 8, the Noise Judge circuit measures the average signal amplitude.
10. The vortex signal is converted from an AC voltage to a DC voltage using a simple rectification circuit. The Noise Judge circuit then outputs a frequency proportional to signal amplitude.
11. The Noise Judge frequency is then input to the CPU for further calculation.
12. **CPU input:** The CPU then uses the frequency inputs to compute actual flow rate, and perform Noise Judge signal discrimination.
13. **Circuit Output:** Based on the software flow diagram (shown below) the CPU outputs a frequency proportional to flow rate. The CPU output frequency may be observed at the CPU PLS and COM1 test points. This frequency output is then converted based on the output selection jumpers to either a 4-20 mA current signal, or frequency.
14. **Analog Output:** If the software and jumpers are set for analog output, the CPU frequency is in the range of 1000 Hz to 5000 Hz. The frequency to current (f/i) circuit will convert this to 4-20 mA.
15. **Pulse Output:** If the software and jumpers are set for pulse output, the CPU frequency will be scaled (or unscaled) according to the software settings. The low level CPU frequency will be converted to a powered voltage output pulse by the pulse output driver circuit as shown.

Software calculation:

The equations at the end of this section describe how the flow rate is calculated from the input frequency. These equations are presented for reference only. It is not necessary to become familiar with them to operate a vortex flowmeter.

The software configuration flow chart is a simplified diagram, some details are left out for clarity.

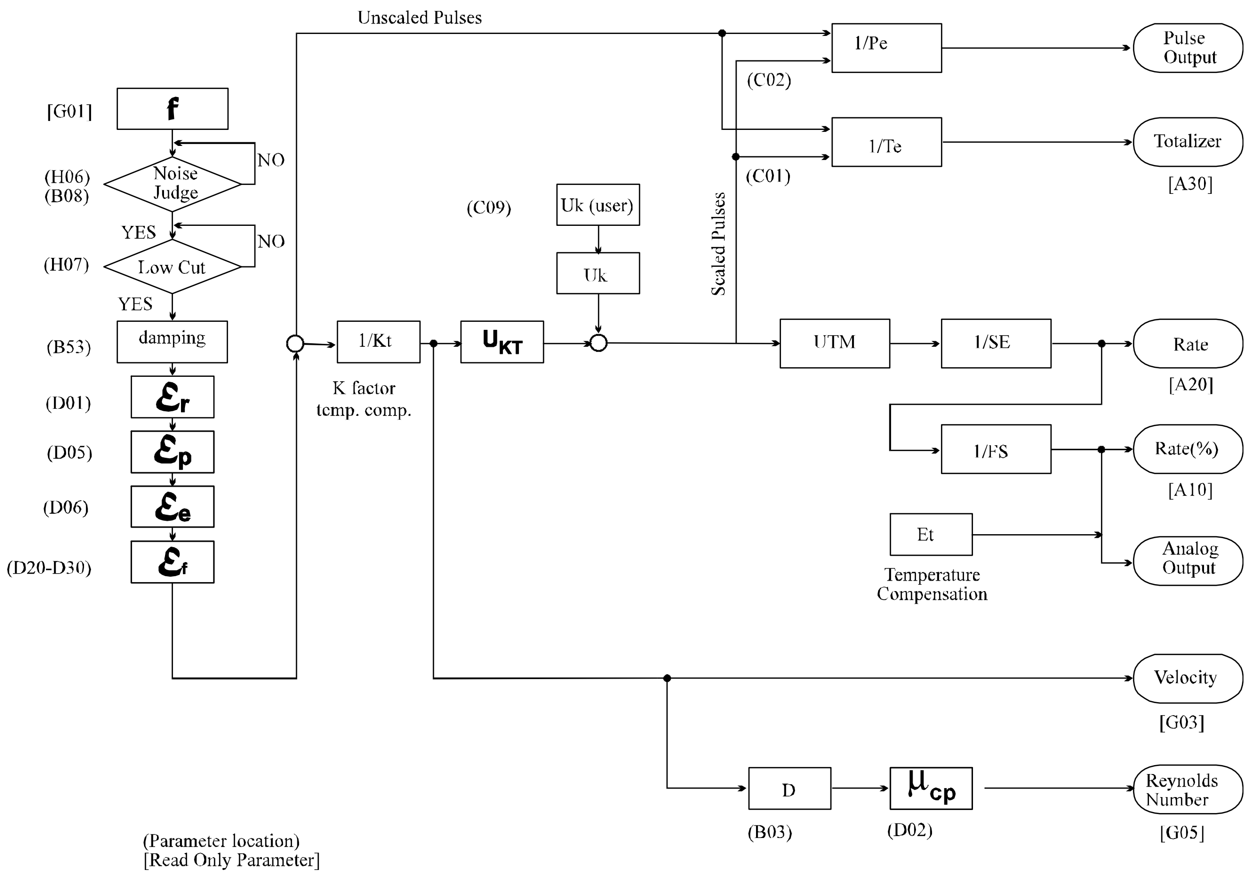


Figure 6.2.2: Software Configuration

1. The flow rate frequency is input to the CPU and displayed in parameter G01.
2. The Noise Judge then discriminates whether this signal is flow rate or noise, based on the settings of B08 (Min. Density) and H06 (Noise Judge). If noise judge determines the signal to be flow, it is passed to Low Cut.
3. The Low Cut function (performed by H07 L.C. Flow rate) determines if the signal frequency is greater than that input at H07, the Low Cut Flow rate. If the signal exceeds Low Cut, it is then passed on to be computed into an actual flow rate and appropriately scaled for output and totalization.
4. The resulting flow signal is then smoothed according to the damping value set in parameter B53.
5. Error correction functions are applied to the damped flow signal. Refer to the appropriate How to listing for details.
6. From this point the CPU calculates the appropriate values for analog and pulse output, and/or for totalization and rate display.

6.3 FLOW COMPUTATION

The flowrate is computed with the following equations based on the N number of generated vortices:

•Flowrate (in engineering units)

$$RATE = N * \frac{1}{\Delta t} * \varepsilon_f * \varepsilon_e * \varepsilon_r * \varepsilon_p * \frac{1}{KT} * U_{KT} * U_k * \frac{1}{S_E}$$

$KT = KM * \{1 - 4.81 \times (Tf - 15) \times 10^{-5}\}$ ...Metric Units

$KT = KM * \{1 - 2.627 \times (Tf - 15) \times 10^{-5}\}$ ...English Units

•Flowrate (%)

$$RATE(\%) = RATE * \frac{1}{F_S}$$

•Totalized value

$$TOTAL = N * \varepsilon_f * \varepsilon_e * \varepsilon_r * \varepsilon_p * \frac{1}{KT} * U_{KT} * U_k * \frac{1}{T_E}$$

$TOTAL = \varepsilon_f * \varepsilon_e * \varepsilon_r * \varepsilon_p * N$ ...Unscaled

•Velocity

$$V = N * \frac{1}{\Delta t} * \frac{1}{KT} * U_{KT} * \frac{1}{\pi D^2}$$

•Reynolds number

$Red = V * D * p_f * \frac{1}{\mu} \times 1000$ ...Metric Units

$Red = V * D * p_f * \frac{1}{\mu} \times 124$ ...English Units

6.3.1 Variable definitions

N	Input pulses counted
Dt	Sample time for N counts (seconds)
ε_r	Reynolds number correction factor (D01 - D03)
ε_p	Pipe schedule correction factor (D05)
ε_e	Expansion correction factor for gas or steam (D06)
ε_f	Flow linearization correction factor (D20 - D30)
KT	K-factor at operating temperature (pulses/litre) (pulses/gal)
KM	K-factor at 15ºC (59ºF) (B06)
U_{kt}	Unit conversion factor for K-factor
U_k	Flow unit conversion factor (Refer to item (2))
U_k(user)	Flow unit conversion factor for user's unit
U_{TM}	Factor corresponding to flow unit time (ex./m (minute) is 60)
S_E	Span factor (ex. E + 3 is 10^3) (B51)
P_E	Pulse rate (ex. E + 3 is 10^3) (C03)
T_f	Temperature at operating conditions (ºC) (ºF) (B10)
M	Mass flow
H	Calorimetric flow

Q_n	Volumetric flow at standard conditions
Q_f	Volumetric flow at operating conditions
ρ_f	Density at operating conditions (B14 or B19)
h_f	Specific enthalpy (kcal/kg), (Btu/lb) (B20)
T_n	Standard temperature
P_f	Operating pressure (kg/cm^2abs), (psia)
P_n	Standard pressure (kg/cm^2abs), (psia) (B27)
K	Deviation factor for gas (B28)
ρ_n	Density at standard temperature and standard pressure (kg/Nm^3), (lb/scf)
F_S	Flowrate span (B52)
T_E	Total rate (C01)
D	Internal diameter (m), (inch) (B03)
μ	viscosity (cP)
ρ_f	Density at operating conditions (kg/m^3), (lb/ft^3)

•Conversion factors

Unit conversion factors:	$U_{k(kg)}$, U_k(cal), $U_k(Nm^3)$, $U_k(m^3)$, U_k(lb), U_k(Btu), U_k(scf), U_k(acf)
Kilogram conversion factors:	$U_{k(kg)}$ = 1 for a kilogram $U_{k(kg)}$ = 0.001 for a metric ton
Actual cubic feet conversion factors:	$U_{k(acf)}$ = 1 for acf $U_{k(acf)}$ = 7.481 for a gallon
K-factor conversion factors:	U_{kt} 1/1000 (litre m^3) U_{kt} 0.3369 (USgal to actual cubic feet)
User's unit conversion factor	$U_k = U_k$ (user) (C09)

For more information, refer to How to setup user defined units in the How to section of this manual.

6.3.2 Flow conversion factor (U_k)

Flow conversion factor U_k is obtained from the following computation depending on the fluid selected (B04) and the flow units.

•Steam

M (Mass flowrate)
$U_k = \rho_f * U_k(kg)$
$U_k = \rho_f * U_k(lb)$

H (Heat quantity)
$U_k = U\rho_f * h_f * Uh_f * U_k(kg)$
$U_k = U\rho_f * h_f * Uh_f * U_k(lb)$

Qf (Flowrate at operation)
$U_k = U_k\ (m^3)$
$U_k = U_k\ (acf)$

•Gas

Qn (Flowrate at STP)
$$U_k = \frac{P_f}{P_n} * \frac{T_n + 273.15}{T_f + 273.15} * \frac{1}{K} * U_k\ (Nm^3)$$

M (Mass flowrate)
$U_k = \rho_f * U\rho_f * U_k(kg)$
$U_k = \rho_f * U\rho_f * U_k(lb)$

Qf (Flowrate) $U_k = U_k$ (m^3)
$U_k = U_k$ (acf)

•Liquid

Qf (Flowrate) $U_k = U_k$ (m^3)
$U_k = U_k$ (acf)

M (Mass flowrate) $U_k = p_f * U$(kg)
$U_k = 7.481 \times \rho_f * U$(lb) (7.481 is a conversion factor of USgal into acf)

6.4 SIGNAL CONDITIONING

6.4.1 YEWFLO Style "E" signal adjustment procedure

The YEWFLO Style "E" vortex flowmeter is a powerful, microprocessor-based instrument whose noise discrimination functions have been factory-set for optimum performance based on customer supplied application information. For most applications, these factory settings are ideal and should not require adjustment by the user. However, difficult applications which generate a noisy output signal may require fine tuning of these functions in an effort to better discriminate signal from noise.

There are five parameters associated with these functions: noise balance, TLA, low-cut frequency, high-cut frequency and noise judge. This procedure will direct the user in the application of these functions based on installation specific symptoms. One or more of these adjustments should correct most of the problems that may be experienced. If problems persist, please contact our Technical Assistance Center (TAC) 800-524-7378.

6.4.2 Problem solving

The type of problems that can be solved using this adjustment procedure include:

- Output occurrence with no flow
- Unstable output at low flow
- High output for a known flow rate
- High output (beyond programmed span)

Before making any adjustments, we recommend exploring other potential reasons and possible solutions for these problems by checking your piping.

6.4.3 Piping checkout procedure

Many noise problems can be solved by some simple changes to the overall piping design. Make the following checks:

- Make sure there is sufficient straight run upstream and downstream. For further recommendations, refer "Piping Requirements".

- Check the installation for excessive vibration - 1g max for gas applications and 2g max for liquid applications. If excessive vibration exists and the pipe is not braced, install appropriate bracing to dampen the vibration. High vibration piping may require remote mounting of the amplifier to reduce the amplitude of any transmitted vibration to the shedder bar. It also may be desirable to mount the meter so the shedder bar is perpendicular to the axis of vibration.

- Check the gaskets to be sure they don't protrude into the flow stream. If they do, trim them as required or reinstall them.

- Be sure that wafer style meters are aligned properly using any alignment devices supplied with the meter.

- If the meter is installed in non-conductive pipe, be sure the body is well grounded using an external strap.

If a remote amplifier is used, confirm the following:

1) The interconnecting cable was factory terminated. If not properly connected, check the termination. Refer to "Cable" for more information.

2) The remote electronics housing is well grounded.

3) Confirm the remote amplifier is correctly connected to the flow tube. If not properly connected, an unexpected output can be generated by the amplifier.

If one or more of the symptoms mentioned above still exist after the piping checkout procedure, perform the Noise Balance Adjustment procedure as follows:

6.4.4 Noise balance adjustment (parameter H01)

This adjustment balances the noise component in the output of the two piezoelectric crystals so that a high signal to noise ratio can be obtained. This is basically a null-balance type adjustment; in other words adjustment should be made throughout the range of possible values (-5 to +10) to determine the lowest noise setting. This is not a simple min/max value setting.

Adjustment is made with a full pipe and no flow. If flow cannot be stopped, the best adjustment is made at low flow rates (less than 1.6 f/s for liquids and 26 f/s for gas).

1) Connect an oscilloscope between test points TP2 and COM2 and observe the signal wave form. Access parameter H01 and make adjustment throughout the range of possible values to obtain the lowest noise component of the wave form. See Figure 6.4.1 below for wave form examples.

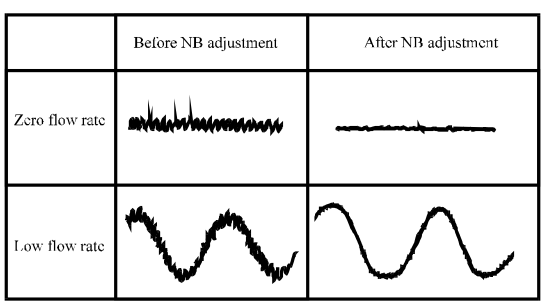


Figure 6.4.1: TP2-COM2 Waveform

2) Connect a voltmeter at test points TP2 and COM2. Although the voltage read will be an RMS value and not peak-to-peak, adjusting H01 to minimize this value will produce the lowest noise component.

3) If an oscilloscope or voltmeter is not available, use parameters H20 and H21 to read the amplitude of the voltage at test points TP2 and COM2. Set parameter H20 to EXECUTE and then access parameter H21 which will display the peak to peak voltage. Adjust H01 until this voltage is at its minimum value.

Note: Each time the H21 parameter is exited for adjustment of H01, it will be necessary to re-execute parameter H20 in order to again read H21.)

If your symptom has not been corrected by this adjustment, perform the adjustment procedure indicated for each symptom:

6.4.5 Noise judge (parameters B08, H06)
Symptom: Output is high for a known flow rate

This filter works to reject noise within the flow range of the meter by acting like a variable TLA (Parameter H02). As density and/or velocity increase, the amplitude of the signal also increases. The Noise Judge makes a judgment, based on the process conditions and the flowing velocity, as to whether the amplitude is related to vortex formation or could only be the result of noise. The amplitude cutoff value of this filter is set by parameter B08 (MINIMUM DENSITY).

1) Access parameter H06 (NOISE JUDGE) and be sure the filter is active.

2) Access parameter B08 (MINIMUM DENSITY) and change the value so it is twice the current value.

3) Observe the meter output at various points throughout the flow range. If the output holds constant or drops-out in spite of increasing flow, lower the value in B08 by 10% and then repeat this step from the beginning. Continue this procedure until the “flat spot” or dropout disappears.

6.4.6 TLA adjustment (parameter H02)
Symptom: Output occurs with no flow “or” output is unstable at low flow

The TLA adjustment (Trigger Level Adjustment) is used to set the minimum measurable flow or meter threshold. The adjustment range is -1 to +2. Adjustment is performed with no flow.

1) Access parameter H02 (TLA). Record the set value and increase that value one step at a time until the output is zero.

2) If the output is now zero, no further adjustment is required.

3) If this adjustment has not been successful, decrease the value of parameter H03 (GAIN) by “1”, reset TLA to original setting and repeat Step 1 until output is zero.

4) If adjustment is still unsuccessful, proceed to Low-Cut Frequency adjustment.

6.4.7 Low-cut flowrate adjustment (parameter H07)

This filter is used to eliminate frequencies below the range of measurement. The adjustment value becomes a multiplier on the default frequency to determine the actual low-cut frequency. The adjustment range is 0.5 to 10.

First determine whether the noise frequency is below your minimum flow requirement:

1) Access parameter G02 (SPAN FREQUENCY) and record this value. Ratio your desired cut off required flow rate (Qcut) to the flow rate corresponding to the span frequency (Qmax). This ratio multiplied by the span frequency results in the frequency at your minimum flow rate; i.e. (Qcut/Qmax)(G02)=Qcut frequency

2) Access parameter G01 (FREQUENCY) input and record this value. If this value is less than the Qcut frequency value, proceed with the low-cut adjustment. If the value is higher, stop here and follow the adjustment procedure for the "output is high for a known flow rate" symptom.

3) Access parameter H07 (LOW-CUT FREQUENCY). Note the set value and increase that value in steps of 0.5 until output is zero.

6.4.8 High-frequency filter adjustment (parameter H04)
Symptom: Output is high (beyond programmed span)

These software parameters filter out frequencies and eliminate such noise as sonic noise, some pump noise and many situations where harmonic noise occurs. There are two parameter settings which affect the high frequency filter.

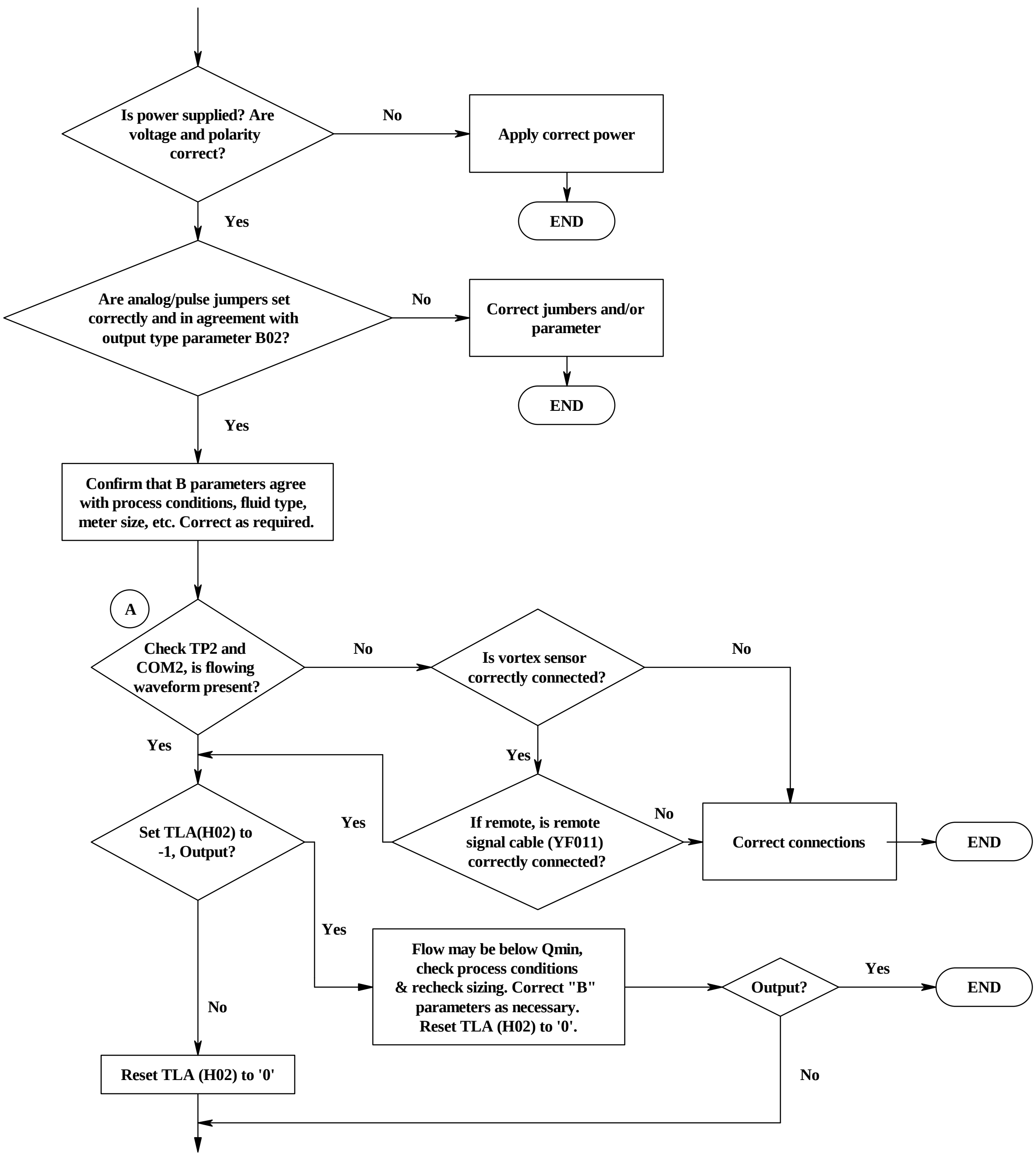
First determine whether the noise frequency is above your maximum flow requirements:

1) Access parameter G02 (SPAN FREQUENCY) and record this value. Then access parameter G01 (FREQUENCY) and record this value. If the G01 value is at least 1.2 times greater than the G02 value, proceed with the high-cut frequency adjustment. Otherwise, take note of the difference between the G01 and G02 values. If there is less than a 20% difference or G01 happens to be less than the G02 value, continuing with this adjustment may mean that readings in the high end of the flow range may not be possible. If you wish to continue with the adjustment, proceed to Step 2.

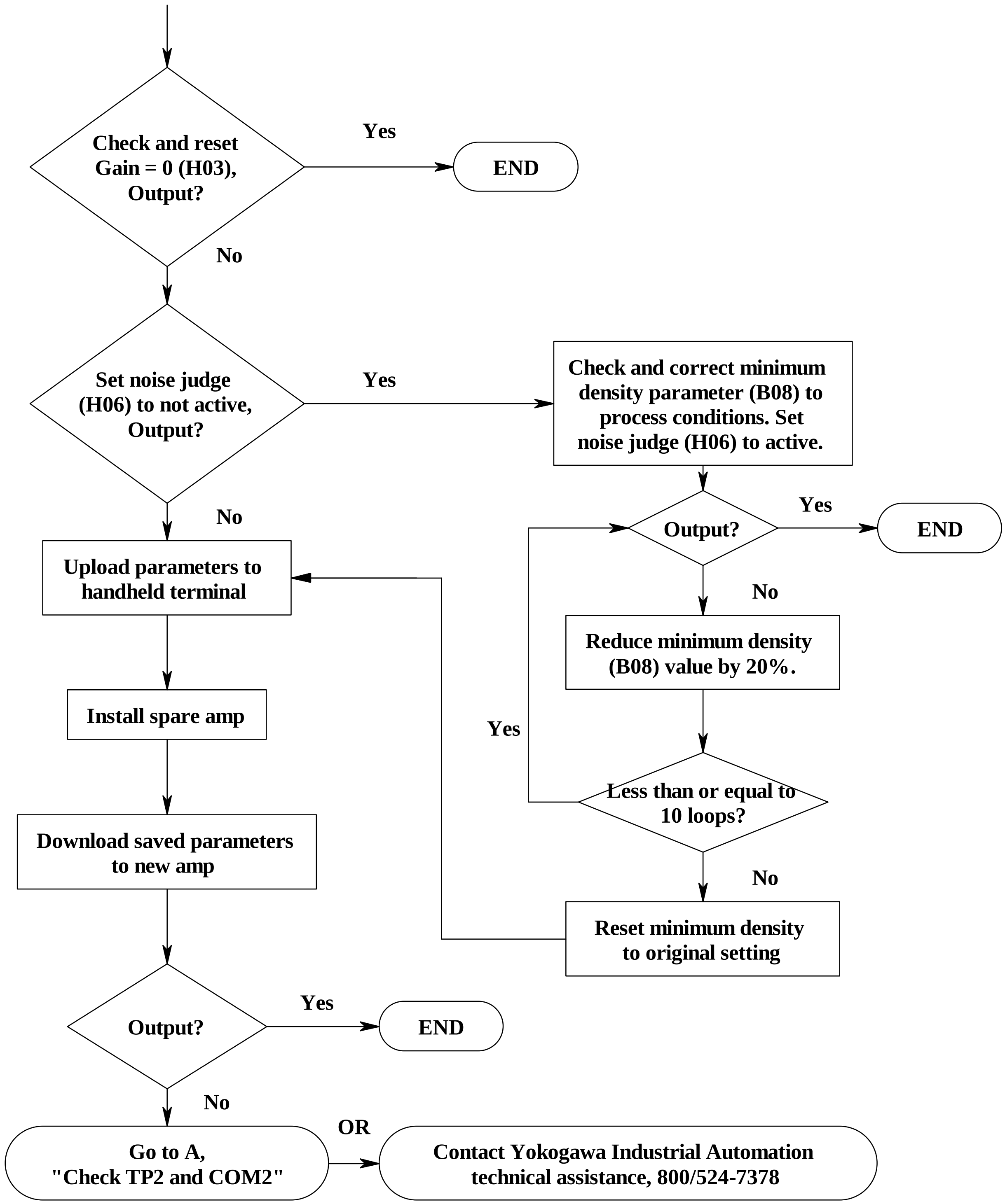
2) Access parameter H04 or H05 (either one is acceptable or both may be used in combination). Increase the set value by one step and observe the output. If output is now zero, adjustment is complete. If not, continue increasing value until output is zero.

6.5 FLOWCHARTS

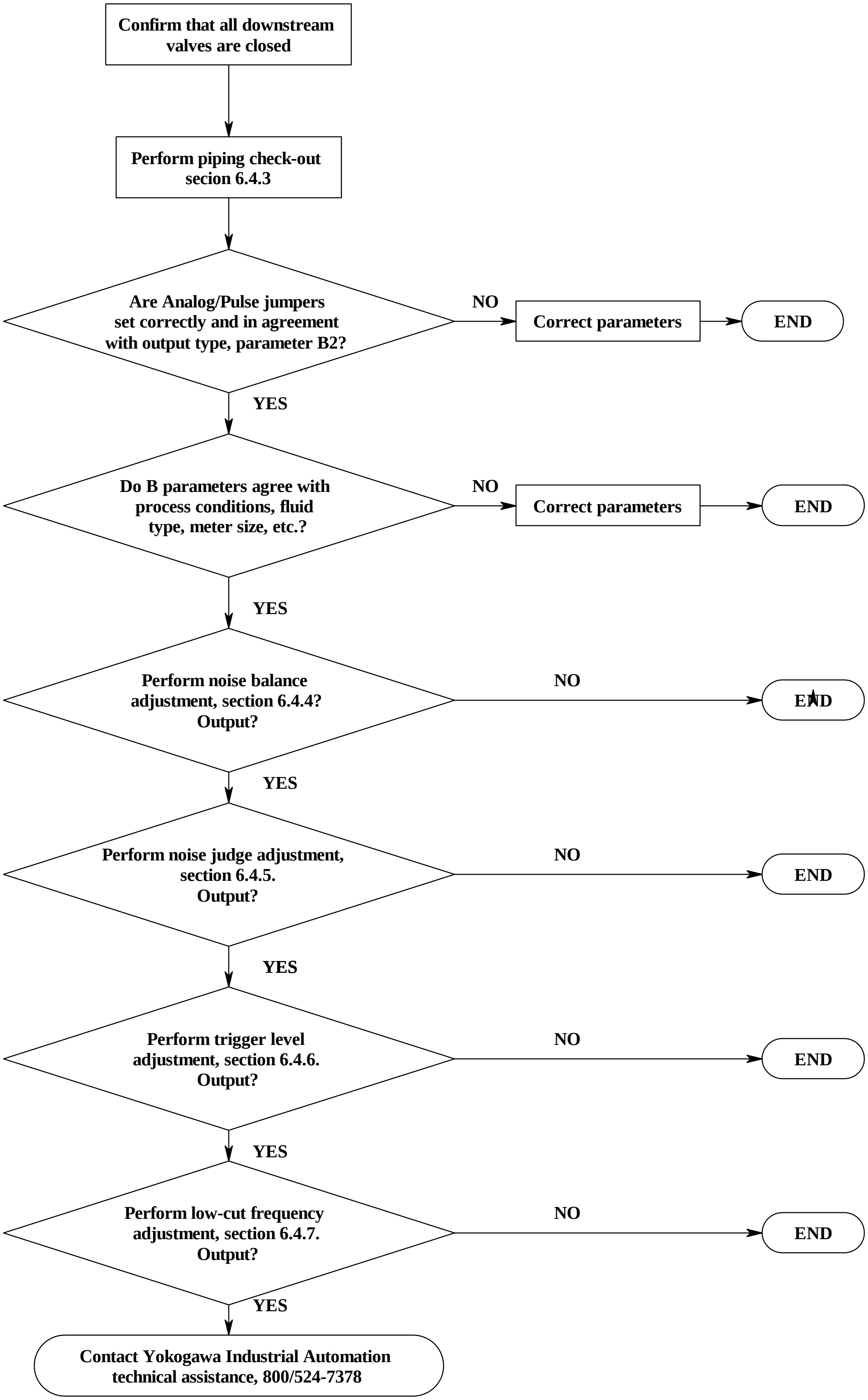
6.5.1 No flowmeter output under flowing conditions



No flowmeter output under flowing conditions (cont.)



6.5.2 Flowmeter output with no flow



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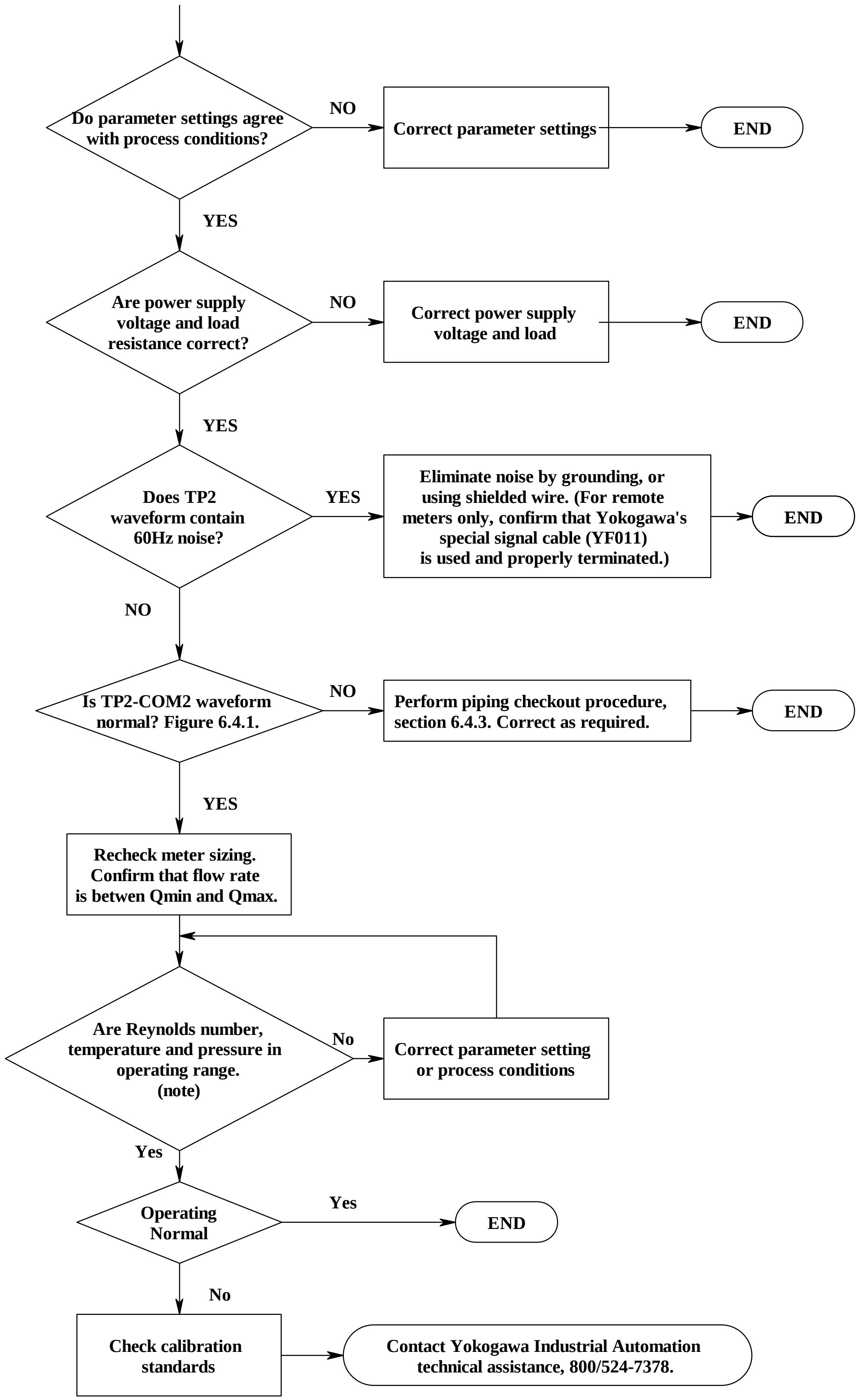
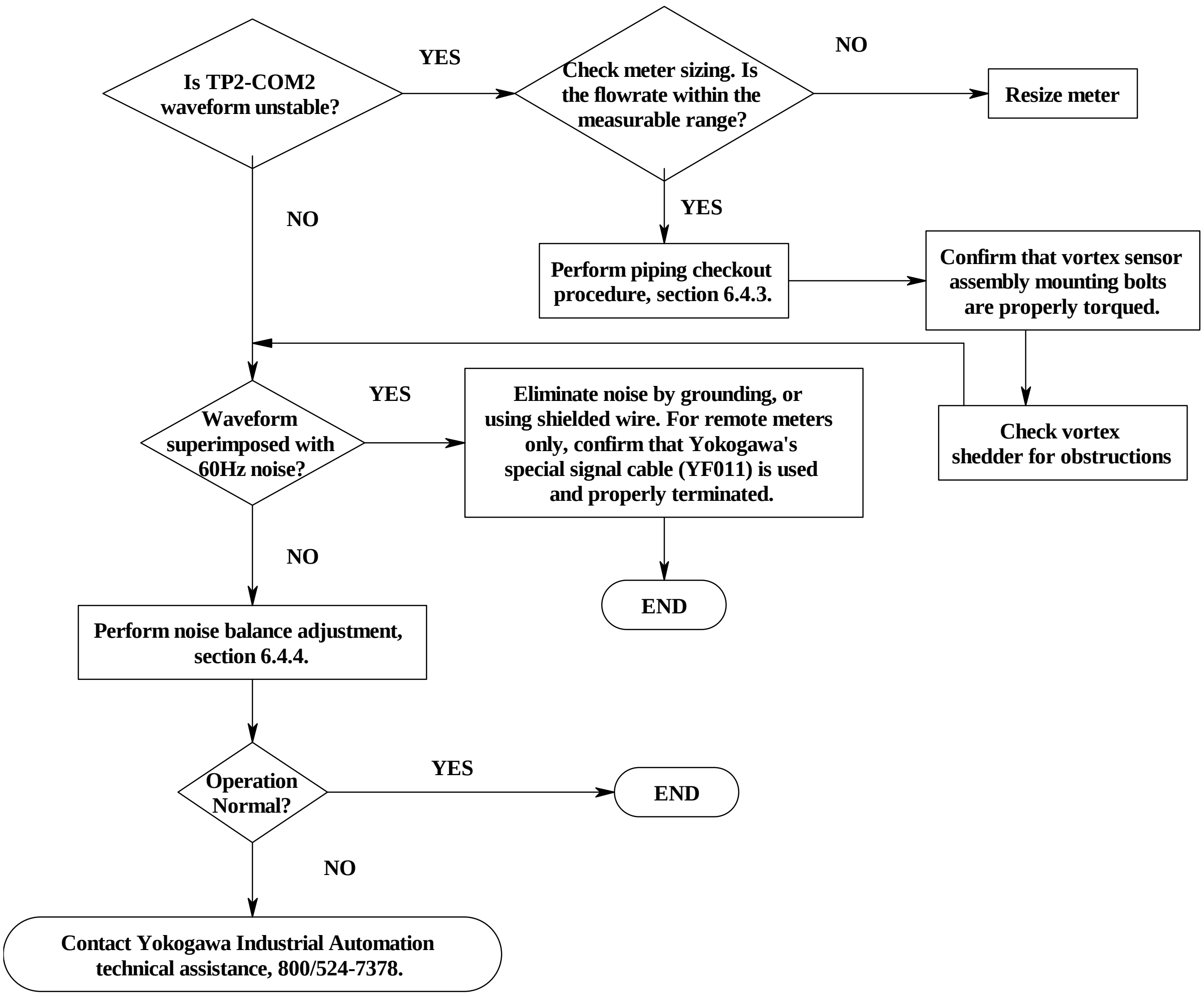
6.5.3 Large flowmeter errors



6.5.4 Output is unstable when flowrate is low



VII. GLOSSARY

ACF: actual cubic feet - The volume which a gas occupies at any given temperature and pressure. The mass of that volume will vary with the changes in the pressure and temperature.

Amplifier assembly - An electronic device which receives an input signal (in the case of YEWFLO frequency of vortex shedding) and controls the output signal such that the output is proportional to the input signal. In the case of YEWFLO this could be either an analog (4-20 mA) signal or frequency proportional to flow rate.

Bluff body - The non-streamlined obstruction placed in the flow stream for the purposes of generating vortices. Also know as the shedder bar.

BRAIN™ communication - The communication protocol for all Yokogawa Smart products. The communication signal is a Frequency Shift Key (FSK) signal superimposed on the 4-20 mA output signal. The frequency is high enough (2400 Hz) that it does not interfere with the 4-20 mA signal and therefore digital communication is transparent to other devices on the signal wires, like recorders or controllers etc.

BT100 - The hand held BRAIN terminal (2 line alphanumeric display) which allows a user to communicate with any of the Yokogawa BRAIN products via the 4-20 mA signal wires. Note: When the YEWFLO is set in the Pulse mode, the BT100 must be connected directly to the connection points on the amplifier circuit board.

BT200 - An enhanced version of the BT100 above. The BT200 has an 8 line display, optional printer, and programmable function keys that further simplify the use of the BRAIN protocol.

Check data - The "G" portion of the YEWFLO parameter Menu used to obtain real-time data on what is happening in the pipeline. Such as instantaneous frequency, or flow velocity etc.

CLR ALM - This function (parameter H10) will allow you to deactivate the overspan alarm and in ignore the over-range span setting error, if you chose to set a span in excess of the nominal maximum flow,. When setting the span value into Parameter B52 the Alarm will indicate if you have set a value in excess of the nominal max for meter size selected. For instance, if you input a liquid flow span such that the velocity is greater than 32 feet per second this alarm will be triggered and will display on the / TBL local indicator. Setting either the span or the meter size incorrectly will cause this alarm. Resetting one of these settings will eliminate the overseen alarm.

Compressibility - The ability of a substance to expand or contract in volume when acted upon by either temperature and/or pressure. Gas are considered compressible whereas liquids are normally considered non-compressible. The extent to which a gas will expand or contract is defined by the perfect gas law. The perfect gas law is a good tool for estimating density of a gas at different pressures and temperatures. Most gases do not follow the perfect gas law exactly, and each gas therefore has a compressibility factor that defines how it will deviate from the perfect gas law. The compressibility factor must be looked up in a reference book or computer program for the specific gas in question. Note: for Natural Gas, the American Gas Association (AGA) provides data on the variable F_{pv}. The compressibility factor for YEWFLO is defined as $1/(F_{pv})^2$, this value is used for sizing and setting the software parameters.

CPU (central processing unit) - This is the portion of the electronics which manages the control of all circuits, computation, communications and outputs. Also know as the microprocessor.

***CSA (Canadian Standards Association)* -** A testing agency located in Canada that reviews and tests instruments to certify that they may be used safely in hazardous areas. See also FM.

***Density* -** The mass of a substance per unit volume. Often expressed in terms of pounds per cubic foot.

***Deviation* -** Parameter B28, where the "Z" factor is entered for gases which do not meet the compressibility requirements necessary to be considered perfect or ideal gases. For Natural Gas per the American Gas Association, $Z=1/(F_{pv})^2$, where F_{pv} is provided from the AGA Handbook.

***EE PROM* -** Refers to internal circuit which maintains data settings permanently even without power.

***Explosion-proof* -** Apparatus enclosed in a housing that is capable of withstanding an explosion of a specified gas or vapor which may occur within it and of preventing the ignition of the specified gas or vapor surrounding the enclosure, and which operates at such an external temperature that a surrounding flammable atmosphere will not be ignited.

***Flanged body style* -** A YEWFLO with flanges integral with the meter body, used to connect the meter body to the pipeline. They are available in 150, 300 and 600 ANSI Class as required for the application.

***Flow conditioner* -** A device that is inserted in the pipeline upstream of a flowmeter for the purposes of providing the proper flow profile necessary to obtain accurate measurement. It is only required when there is not sufficient space to permit the normally required straight pipe ahead of the flowmeter.

***Fluctuation* -** Parameter G20. When set to execute, this parameter traps the max or min flow rate and stores these values in G21 and G22. To reset the values set G20 to not execute and then back to execute.

***FM (Factory Mutual)* -** a company that reviews and tests instruments to assure that they will not cause an explosion when properly used in a hazardous area.

***Frequency* -** The number of repetitions of a periodic process in a unit of time. In the case of a vortex meter, the frequency of the vertices being shed is proportional to the velocity of the flowing medium within a pipeline.

***Gain* -** The ratio of output change to input change at a specified frequency.

***Hertz* -** A measure of the frequency in terms of cycles per second.

***Integral converter* -** The YEWFLO electronics housing containing the amplifier circuit board when it is attached directly to the flowmeter body.

***Intrinsically safe* -** An instrument designed such that in the event of any electronic circuit failure there will not be sufficient energy released that a spark could touch off an explosion. This in normally tested and certified by FM, CSA, or other certifying agency.

***K-factor* -** The number of pulses or vortices shed per unit volume. Normally expressed as pulses per gallon.

***Linear* -** Performance of a flowmeter so that if the points on the flow scale are plotted on a curve the resulting curve will be a straight line. Does not require the use of a square root extractor. All graduations on the flowmeter scale are equally spaced.

Mass **-** The weight of a fluid normally expressed in pounds or kilograms. Mass flow is the flow rate expressed in weight units per unit time such as pounds per hour.

N balance **-** Noise Balance a Parameter used to reduce the effects of vibration or pipe noise which may cause the meter to have an output when there is no flow. Adjusting this parameter will not affect the meter accuracy or K-factor.

L. C. flow rate - The parameter (H07) sets a flow rate below which the flowmeter output will always be zero. This is normally set at the factory at 90% of the nominal minimum measurable flow.

Normal conditions **-** A term frequently found when the operating conditions are given in metric units. The temperature is 0°C and 14.7 PSIA as opposed to the English Standard conditions of 60°F and 14.7 PSIA. Note: Standard Conditions are used most frequently in North America.

Operating conditions **-** The fluid properties of specific gravity, viscosity, density, temperature and pressure at which the flowmeter will be expected to perform its meter function.

Parameter **-** A portion of the configuration of the YEWFLO where information is entered and/or read using either the BT100/BT200 or TBL.

Piezoelectric crystals **-** the sensor used in the YEWFLO. When there is a change in the stress applied to the piezoelectric crystal, a momentary voltage spike is generated. The crystal is not sensitive to static pressure or stress, it only reacts to changes in the stress.

Pipe effect **-** The YEWFLO is designed to operate installed in schedule (sch) 40 pipe. Other pipe schedules such as sch 10 or sch 80 have different internal dimensions. This will mismatched pipe bore can affect the meter factor (K-factor). This error can be corrected out by activating the Pipe Effect parameter (D05) and selecting the correct combination of process connection and piped schedule.

Remote converter **-** Electronics for the YEWFLO which are located up to 65 feet away from the vortex meter body.

Reynolds number **-** A dimensionless number taking into account the flowing velocity, fluid density and viscosity and the pipe cross-sectional area. It provides a means to predict the flow profile of the fluid within the pipe under flowing conditions.

Self-check **-** The YEWFLO electronics checks all phases of the meter's performance any diagnostic errors are displayed at any menu (Letter) with parameter value (number) of 60, i.e. A60, D60 etc.

Shedder bar - The bluff body or non-streamlined object located in the middle of the flow stream by which vortex swirls are formed and detached or shed.

Span frequency **-** The frequency of vortex shedding that would be generated at 100% of span setting, and would generate 20 mA output in the case of an analog output meter.

Span velocity **-** The velocity of the flow at the span setting (20 mA). Normally expressed in terms of meters per second.

Standard cubic feet (SCF) **-** A volume equal to a cubic foot of gas when allowed to expand or contract so that the pressure is 14.7 PSIA and 60ºF.

Strouhal number - A dimensionless number that when constant defines the region of linear flow measurement. This value is defined by geometric dimensions..

Style 'E' YEWFLO - The current design of the YEWFLO. An intelligent vortex flowmeter, utilizing microprocessor electronics, custom Application Specific Integrated Circuits (ASIC) and surface mount assembly technology.

TBL - An optional local digital indicator used with the YEWFLO to indicate the rate of flow or total flow. It is also capable of doing some of the configuration of the YEWFLO electronics to match the meter to the application.

Terminal box - A small housing mounted on top of the vortex meter body. It is only required when the electronics converter is mounted remotely. Its purpose is to provide a junction box for the wires coming from the vortex sensor and the cables to the remote converter.

TLA (trigger level adjustment) - An adjustment or setting in the YEWFLO electronics which determines the minimum amplitude of vortex signal to be detected by the sensor. Signal amplitudes below the TLA setting will be ignored.

TP2 (test point 2) - Located on the YEWFLO amplifier circuit board, this is the amplified signal from the shedder bar. The wave form is typically sinusoidal in shape. At high flow rates the wave form tends to flatten on the top and bottom.

TP2(Vp-p) - Displays the peak to peak amplitude of the signal output from the sensor as found on test point TP2.

Velocity - The speed at which a fluid travels within a pipe. Usually expressed in meters per second.

Viscosity - The internal resistance to flow within a fluid. The shear of the liquid or gas tending to prevent the flow of the fluid. In the case of a liquid, the viscosity decreases as the temperature increases. In a gas, the viscosity increases as the temperature increases.

Volumetric flow - Fluid flow that is metered in volumetric units such as gallons or cubic feet without regard to the weight or mass per unit volume.

Von Karman vortex street - The pattern of vortex swirls being shed from the bluff body. Named after T. Von Karman who did considerable research on the vortex shedding phenomenon in the early days of the 20th century.

Wafer body style - YEWFLO meter body held in the pipeline by clamping between the mating flanges using long bolts and nuts. The meter body itself does not have flanges, but relies on the clamping pressure to seal against leakage.

Appendix A: Parameter Details

The following table lists each parameter as it would be displayed via the BT100 or BT200 handheld terminal (HHT) or the local digital indicator/operator interface, (option code TBL). The information provided in each column is defined below.

Parameter No.: Menu and parameter identification number as shown in the HHT display.

Parameter Name: Abbreviated alphanumeric name describing the parameter function.

Data Range: The available range of data for each parameter. There are three basic types of data; list, numeric and alphanumeric. List type data requires you to select from the available list. Numerical or alphanumeric data require you to enter a value. Some parameters are read only, and they will be indicated in this column. Please note, all YEWFLO flow meters are pre-configured before shipping as specified by the customers application. Therefore, no default settings are shown.

Indicator/Interface (TBL) Parameter No.: This alphanumeric value is analogous to the parameter number above. The indicator is unable to display a full alphabet, therefore this coded identification is required when using the local digital indicator /operator interface for parameter setting. The data in this column is the first two (leftmost) characters displayed on the indicator. A limited number of parameters can not be changed or viewed from the indicator/interface (TBL), these parameters are noted as no access.

Indicator/Interface Code: The number shown in this column is the code number used to indicate the selected value in the corresponding data range column. When an actual numeric value is to be input use the proper sequence of the **SET / SHIFT / INC** keys on the indicator/interface to enter the value. See "Parameter setting in BRAIN communications" for more details.

Help / Remarks: This column provides further explanation on each parameter as necessary.

Please reference section 6.2 for a detailed description of circuit and software operations.

Appendix A: Parameter Details

Hand Held Terminal Parameter No. and Name	Data Range	Indicator/Interface		Help / Remarks
		Prmtr No.	Code No.	
A: Display	Read only	No access		Beginning of Menu A which provides real time information. on flow.
A10: Flow Rate%	0.0 to 110.0 Read only	No access		Flow rate in % of span is displayed and updated every 5 sec.
A20: Flow Rate	0 to 65535 Read only	No access		Actual flow rate is displayed in desired engineering units and updated every 5 sec.
A30: Total	0 to 999999 Read only	No access		Totalized flow is displayed along with the total units and updated every 5 sec.
A60: Self-check	Good Error Read only	No access		Diagnostic self-check. If good is displayed no error exists. See "How To Use Diagnostics" for details.
B: Set 1	Read only	No access		Beginning of Menu B for basic configuration settings.
B01: Tag No.	16 characters	No access		Customer designated alphanumeric tag no.
B02: Output	4 to 20 mA Pulse	02	0 1	Select the output mode. See "How to change the output mode to Analog or Pulse" for details.
B03: Size	.5 in (15 mm) 1 in (25 mm) 1.5 in (40 mm) 2 in (50 mm) 3 in (80 mm) 4 in (100 mm) 6 in (150 mm) 8 in (200 mm) 2 in (50 mm HPT) 3 in (80 mm HPT) 4 in (100 mm HPT) 6 in (150 mm HPT) 8 in (200 mm HPT) 1 in (25 mm HPT) 1.5 in (40 mm HPT) 10 in (250 mm) 12 in (300 mm)	03	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Select the meter size from this list. NOTE: The HPT code signifies that the sensor is designed for High Process Temperature. Use the HPT settings only if the /HPT option code is shown on the flow meter nameplate. The HPT operating range is 575º - 750°F. The meter size is displayed in mm only.
B04: Fluid	Steam M Steam H Steam Qf Gas Qn Gas M Gas Qf Liq Qf Liq M	04	0 1 2 3 4 5 6 7	Select the fluid type to be measured: M refers to mass flow units (i.e. lb/hr) H refers to energy flow (i.e. Btu/hr) Q refers to volumetric flow n refers to standard conditions (i.e. SCFM) f refers to operating conditions (i.e. ACFH or GPM)
B05: K-Factor Units	P / l P / US gal P / UK gal	05	0 1 2	Select the units for the K factor which will be entered below in B06.
B06: K - Factor	0.00001 to 32000	06	0.00001 to 32000	Enter the K-factor (at 59°F) as stamped on the flow meter body.
B07: Density Units	kg/m3 lb/acf lb/US gal lb/UK gal	07	0 1 2 3	Select the fluid density units.

Appendix A: Parameter Details

Hand Held Terminal	Data Range	Indicator/Interface		Help / Remarks
Parameter No. and Name		Prmtr No.	Code No.	
B08: Min. Density f	0.00001 to 32000	08	0.00001 to 32000	Enter the minimum flowing density using the units of B07, this parameter works in conjunction with Noise Judge to reject erroneous flow signals.
B09: Temp Unit	ºC ºF	09	0 1	Select the temperature units.
B10: Temp f	-500.0 to 1000	10	-500.0 to 1000	Enter the operating Temperature in units of B09.
When the Fluid (parameter B04) is Steam M, Gas M, or Liq M complete B14 and B15 (otherwise not displayed).				
B14: Density f	0.00001 to 32000	14	0.00001 to 32000	Enter the fluid density at operating conditions based on the units of measure as specified in B07.
B15: Flow Unit	kg ton lb	15	0 1 2	Select the Mass flow units to be used. ton = Metric Ton
When the Fluid (parameter B04) is Steam H complete B19 through B22 (otherwise not displayed).				
B19: Density f	0.00001 to 32000	19	0.00001 to 32000	Enter the density of the fluid at operating conditions based on the units of measure as specified in B07.
B20: Enthal Unit	Kcal / kg KJ / kg Btu / lb	20	0 1 2	Select the specific enthalpy units to be used.
B21: SPE Enthalpy	0.00001 to 32000	21	0.00001 to 32000	Enter value of specific enthalpy using the units specified in B20.
B22: Flow Unit	kcal Mcal KJ MJ Btu	22	0 1 2 3 4	Select the energy flow units to be used.
When the fluid in B04 is Gas Qn complete B25 through B29 (otherwise not displayed).				
B25: Temp n	-500.0 to 1000.0	25	-500.0 to 1000.0	Enter the temperature of the fluid at standard conditions using the same units as specified in B09.
B26: Pressure f	0.00001 to 32000	26	0.00001 to 32000	Enter the operating pressure in absolute units.
B27: Pressure n	0.00001 to 32000	27	0.00001 to 32000	Enter the pressure at standard conditions in the same units as used in B26.
B28: Deviation	0.00001 to 32000	28	0.00001 to 32000	Enter the ratio of compressibility at flowing conditions to that at standard conditions. [Z factor]
B29: Flow Unit	Nm3 Nl scf	29	0 1 2	Select the standard flow units to be used. Scf reference temperature is 59°F; Nm3 and Nl reference temperature is 0°C
When the fluid in B04 is Steam Qf, Gas Qf or Liq Qf complete B35 (otherwise not displayed)				
B35: Flow unit	m3 (actual) l (actual) acf US gal UK gal	35	0 1 2 3 4	Select the flow units to be used.
B50: Time Unit	/ s / m / h / d	50	0 1 2 3	Select the proper time units for the flow span : Note: when units of /s or /d are selected, neither the flow unit nor the time unit is displayed on the local indicator (/TBL).
B51: Span Factor	E 0	51	0	If the flow span to be entered in parameter B52 will be

Hand Held Terminal	Data Range	Indicator/Interface		Help / Remarks
Parameter No. and Name		Prmtr No.	Code No.	
	E + 1 E + 2 E + 3 E + 4 E + 5 E - 5 E - 4 E - 3 E - 2 E - 1		1 2 3 4 5 6 7 8 9 10	a number greater than 32000 (regardless of decimal point) select the appropriate multiplier value. This value will be used in conjunction with that entered into parameter B52. Example: a 500,000 flow span could be entered as: B51 : E + 4 = 10^4 =10,000 B52 : 50 See "How to adjust Zero and Span" for more details.
B52: Flow Span	0.00001 to 32000	52	0.00001 to 32000	Enter the desired span value. If this value is greater than 32,000 use a multiplier factor in parameter B51.
B53: Damping	2 4 8 16 32 64 0	53	0 1 2 3 4 5 6	Select the damping required.
B60: Self-check	Good Error Read only	No access		Diagnostic self-check. If good is displayed no error exists. See "How To Use Diagnostics" for details.
C: Set 2	Read only	No access		This signifies the beginning of Menu C which is where the totalizer, pulse rate and special units may be set.
C01: Total Rate	E 0 E + 1 E + 2 E + 3 E + 4 E + 5 E - 5 E - 4 E - 3 E - 2 E - 1 UNSC*1 UNSC*10 UNSC*100	C1	0 1 2 3 4 5 6 7 8 9 10 11 12 13	Select the totalizer x10 multiplier for the integral totalizer. E 0 = 1 (10^0) flow unit per count E + 1 = 10 (10^1) flow units per count E + 2 = 100 (10^2) flow units per count E + 3 = 1000 (10^3) flow units per count E + 4 = 10000 (10^4) flow units per count E + 5 = 100000 (10^5) flow units per count E - 5 = 0.00001 (10^{-5}) flow units per count E - 4 = 0.0001 (10^{-4}) flow units per count E - 3 = 0.001 (10^{-3}) flow units per count E - 2 = 0.01 (10^{-2}) flow units per count E - 1 = 0.1 (10^{-1}) flow units per count UNSC *1 = K factor x 1 = 1 count/pulse input UNSC*10 = K factor x 10 = 10 counts/pulse input UNSC*100 = K factor x 100 = 100 counts/pulse input
C02: Pulse Rate	 E 0 E + 1 E + 2 E + 3 E + 4 E + 5 E - 5 E - 4 E - 3 E - 2	C3	 0 1 2 3 4 5 6 7 8 9	Select the pulse output x10 multiplier E 0 = 1 (10^0) flow unit per pulse E + 1 = 10 (10^1) flow units per pulse E + 2 = 100 (10^2) flow units per pulse E + 3 = 1000 (10^3) flow units per pulse E + 4 = 10000 (10^4) flow units per pulse E + 5 = 100000 (10^5) flow units per pulse E - 5 = 0.00001 (10^{-5}) flow units per pulse E - 4 = 0.0001 (10^{-4}) flow units per pulse E - 3 = 0.001 (10^{-3}) flow units per pulse E - 2 = 0.01 (10^{-2}) flow units per pulse

Appendix A: Parameter Details

Hand Held Terminal Parameter No. and Name	Data Range	Indicator/Interface Prmtr No.	Indicator/Interface Code No.	Help / Remarks
	E - 1 UNSC*1 UNSC*10 UNSC*100		10 11 12 13	E - 1 = 0.1 (10^{-1}) flow units per pulse UNSC *1 = K factor x 1 = 1 pulse out/pulse in UNSC*10 = K factor x 10 = 10 pulses out/pulse in UNSC*100 = K factor x 100 = 100 pulses out/pulse in
C09: Unit Conv. Fa	0.00001 to 32000	C9	0.00001 to 32000	Use when custom flow units are needed. Value = (std. span units/custom unit) Refer to "How to set up for user defined flow units" for details.
C10: Users Unit	8 characters	No access		Using the Alphanumeric keys enter the name of the custom flow unit. Only the first 3 characters will be displayed in Parameter: A20.
C60: Self-check	Good Error Read only	No access		Diagnostic self-check. If good is displayed no error exists. See "How To Use Diagnostics" for details.
D: Adjust	Read only	No access		This signifies the beginning of the D Menu. This Menu allows access to special compensation features.
D01: Reynolds Adj	Not active Active	d1	0 1	This parameter is used to improved accuracy when measuring flow between a Reynolds No. Of 5,000 and 20,000. Accurate viscosity and density values must be provided. Refer to "How to activate Reynolds Number correction" for details.
D02: Viscosity	0.00001 to 32000	d 2	0.00001 to 32000	Enter operating viscosity in centipoise, for use with Reynolds number correction only.
D03: Density f	0.00001 to 32000	d 3	0.00001 to 32000	Enter operating density units per B07, for use with Reynolds Number correction only.
D05: Pipe Effect	Not active Wafer Sch 10 Wafer Sch 40 Wafer Sch 80 Flange Sch 10 Flange Sch 40 Flange Sch 80	d 5	0 1 2 3 4 5 6	This function corrects for errors that may be caused when YEWFLO is installed in pipe other than Sch 40 Pipe. To invoke this function, select the connection and pipe Sch from the list. Refer to "How to activate Mis-matched pipe schedule correction" for details.
D06: Expansion FA	Not active Active	d 6	0 1	This function improves gas accuracy above 35 m/s to 0.8% of rate, when metering a compressible fluid (Gas or Steam). To activate this function, select ACTIVE. Refer to " How to increase gas and steam accuracy by correcting for gas expansion" for details.
D20: Flow Adjust	Not active Active	No access		Select active to activate this linearization feature and input the appropriate data in parameters D21 through D30. The correction data for this function requires special calibration. Call Factory for details.
D21: Freq 1	0.00001 to 32000	No access		First Break Point Frequency (Hz)
D22: Data 1	-50.00 to 50.00	No access		First Break Point Correction (%)
D23: Freq 2	0.00001 to 32000	No access		Second Break Point Frequency (Hz)
D24: Data 2	-50.00 to 50.00	No access		Second Break Point Correction (%)
D25: Freq 3	0.00001 to 32000	No access		Third Break Point Frequency (Hz)
D26: Data 3	-50.00 to 50.00	No access		Third Break Point Correction (%)
D27: Freq 4	0.00001 to 32000	No access		Fourth Break Point Frequency (Hz)
D28: Data 4	-50.00 to 50.00	No access		Fourth Break Point Correction (%)
D29: Freq 5	0.00001 to 32000	No access		Fifth Break Point Frequency (Hz)
D30: Data 5	-50.00 to 50.00	No access		Fifth Break Point Correction (%)

Appendix A: Parameter Details

Hand Held Terminal	Data Range	Indicator/Interface		Help / Remarks
Parameter No. and Name		Prmtr No.	Code No.	
D60: Self-check	Good Error Read only	No access		Diagnostic self-check. If good is displayed no error exists. See "How To Use Diagnostics" for details.
E: Control	Read only	No access		This signifies the beginning of Menu E for configuration of the local indicator.
E01: Total Reset	Not execute Execute	E1	0 1	Select Execute to reset the integral totalizer.
E02: Disp Select	Rate (%) Rate Total Rate (%), Total Rate , Total Rate, Rate (%)	E2	0 1 2 3 4 5	Select the desired display mode for the list. Comma separated items will alternate every 4 sec.
E60: Self-check	Good Error Read only	No access		Diagnostic self-check. If good is displayed no error exists. See "How To Use Diagnostics" for details.
F: Test	Read only	No access		This signifies the beginning of Menu F. For loop testing purposes.
F01: Out Analog	0.00001 to 110.00 %	F1	0.00001 to 110.00	To check the operation of the analog output loop, input a value between 0 and 110%. The current output and the Rate% display will respond to this input. Engineering unit display and totalization will continue to measure the true flow reading.
F02: Out Pulse	0.00001 to 6000 Hz	F2	0.00001 to 6000	To check the operation of the pulse output circuit, input a frequency value between 0 and 6000Hz. The pulse output will respond to this input. All display and totalization functions will continue to measure the true flow reading.
F60: Self-check	Good Error Read only	No access		Diagnostic self-check. If good is displayed no error exists. See "How To Use Diagnostics" for details.
G: Check Data	Read only	No access		This signifies the beginning of Menu G. Real time information regarding the process will be displayed within this menu.
G01: Frequency	Read only	No access		Displays actual frequency of vortex shedding, in Hz
G02: Span Freq	Read only	No access		Displays calculated span frequency, in Hz, which corresponds to the 20 mA value. Including any effects of correction factors in the D menu.
G03: Velocity	Read only	No access		Displays velocity of the fluid in m/s. 1 m/s = 3.28 ft/sec
G04: Span Vel	Read only	No access		Displays velocity, in m/s, which corresponds to the span, or 20 mA value, of the meter. 1 m/s = 3.28 ft/sec
G05: Reynolds	Read only	No access		Displays 1/1000 of the Reynolds number corresponding to the measured flow rate.
G20: Fluctuation	Not execute Execute	No access		Executing this parameter resets and starts the collection of Max and Min flow data for display in parameter G21 (Max) and G22 (Min).
G21: Max Flow	Read only	No access		Maximum flow reading since the last execute of G20. Display value 0 - 110% span.

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Hand Held Terminal Parameter No. and Name	Data Range	Indicator/Interface Prmtr No.	Indicator/Interface Code No.	Help / Remarks
G22: Min Flow	Read only	No access		Minimum flow reading since the last execute of G20. Display value 0 - 110% span.
G60: Self-check	Good Error Read only	No access		Diagnostic self-check. If good is displayed no error exists. See "How To Use Diagnostics" for details.
H: Maintenance	Read only	No access		This signifies the beginning of the Maintenance Menu.
H01: N. Balance	-5 to 10 Factory Set	H1	-5 to 10	Noise Balance: This parameter is factory set to match the sensor crystals for maximum signal to noise ratio. Field adjustment should be done only by a trained technician, or as directed by the Factory. Refer to "Troubleshooting" for more details.
H02: TLA	-1 0 1 2 default is 0	H2		Trigger Level Adjustment: Factory default is 0 This adjustment is used to suppress the effects of pipe vibration noise on the output signal. -1 is very sensitive and 2. Refer to "Troubleshooting" for more details
H03: Gain	16 steps default is 0	H3	16 steps	Amplifier Gain: Factory default is 0 Gain is set automatically by values input in the B menu. Consult the factory prior to adjusting this parameter, or refer to "Troubleshooting" for more details.
H04: H. F. Filter	16 steps default is 0	H4	16 steps	High Frequency Filter: Factory default is 0 Filter is set automatically by values input in the B menu. This parameter is used to high frequency noise. Consult the factory prior to adjusting this parameter, or refer to "Troubleshooting" for more details.
H06: Noise Judge	Not active Active	H6	0 1	Dynamic Noise Reduction: This parameter determines if the input received is noise or flow signal by comparing amplitude and frequency to predicted values. Parameter B08 Min. Density Flowing adjusts the cutoff value of this function up and down. When injecting a frequency signal into TP2 for amplifier calibration this parameter must be in the Not Active mode. Refer to "Calibration" and "Troubleshooting" for details.
H07: L.C. Flowrate	0.00001 to B52 value	H7	0.00001 to B52	This parameter sets the low flow cut off value. Any signal below this value will be ignored. Refer to "How to set the Low Flow cutoff value" for details.
H08: Trim 4 mA	-1.0000 to 10.000 %	No access		This parameter is used for fine adjustment of the 4 mA output. Refer to "How to trim the 4-20 mA output" for more details.
H09: Trim 20 MA	-10.000 to 10.000 %	No access		This parameter is used for fine adjustment of the 20 mA output. Refer to "How to trim the 4-20 mA output" for more details.
H10: CLR. Err2	Not active Active	No access		ERR #2 on the local indicator, warns that the span value in B52 exceeds 32.8 ft/sec for liquids, or 262 ft/sec for gas or steam. Select Active to disable this warning.
H20: Measure TP2	Not execute Execute	No access		Select Execute to allow digital display of the TP2 test point voltage in parameter H21 (Volts, peak-to-peak).

Hand Held Terminal	Data Range	Indicator/Interface		Help / Remarks
Parameter No. and Name		Prmtr No.	Code No.	
H21: TP2 (Vp-p)	0 to 9.99 Read only	No access		You must Execute parameter H20 immediately prior to entering this parameter to display the TP2 value. Re-execute parameter H20 each time after leaving H21.
H30: Revision	Read only	No access		This parameter displays the current revision number of the software.
H60: Self-check	Good Error Read only	No access		Diagnostic self-check. If good is displayed no error exists. See "How To Use Diagnostics" for details.
M: MEMO	Read only	No access		This signifies the beginning of menu M, for memo pad.
M01: Memo 1	16 characters	No access		Memo pad for miscellaneous data. (16 characters)
M02: Memo 2	8 characters	No access		Memo pad for miscellaneous data. (8 characters)
M60: Self-check	Good Error Read only	No access		Diagnostic self-check. If good is displayed no error exists. See "How To Use Diagnostics" for details.

Appendix B: HART Parameter Details

Menus							R/W	BRAIN
							Note 1	Note 2
Offline	Offline Configure	New Device	Rosemount	Vortex	Dev vl. DD vl.	...See Note 3		
			Yokogawa	YEWFLO	Dev vl. DD vl.		R&W	
		Last Device						
	Simulation	Rosemount	Vortex	Dev v5. DD vl				
		Yokogawa	YEWFLO	Dev vl. DD vl				
Online	...see detailed listing below							
Transfer	Device to Memory							
	Memory to Device							
Frequency Device								
Utility	Auto Poll							
	contrast							
	Hot Key	Span					R&W	B52
	(Top)							
Online	Device Setup	Process Variables	PV				R	A20
			PV % range				R	A10
			PV AO				R	
			Total				R	A30
		Diag/Service	Test Device	Self Test				[ ] 60
				Status	...See Note 4		R	
			Loop Test	Loop Test	4 mA, 20 mA, other			F01
				Pulse Output Test				F02
			Calibration	D/A Trim	4 mA			H08
					20 mA			H09
				Scaled D/A Trim	(for 4 mA)			
					(for 20 mA)			
			Output Select	Analog Out, Pulse Out			R&W	B02
		Basic Setup	Tag				R&W	B01
			Span				R&W	B52
			PV Damp				R&W	B53
			Device info	Manufacture			R	
				Tag			R&W	B01
				Descriptor			R&W	M01
				Message			R&W	
				Date			R&W	
				Dev id			R	
				Write protect	No		R	
				Revision #s	Universal rev		R	
					Fld dev rev		R	
					Software rev		R	
					Hrdware rev		R	
		Detailed setup	Measuring elements	Line size	15, 25, 40, 50, 80, 100, 150, 200, 250,		R&W	B03

Appendix B: HART Parameter Details

Menus						R/W	BRAIN
			300 mm; 25, 40, 50, 80, 100, 150, 200 HPT; 250,				
		K-factor	K-factor val.			R&W	B06
			K-factor unit	p/L, p/gal, p/UKgal		R&W	B05
		Density	Min. density			R&W	B08
			Density unit	kg/M3, lb/acf, lb/gal, lb/UKgal		R&W	B07
		Temperature	Temp f				B10
			Temp unit	degC, degF			B09
		Fluid	Steam M, Steam H, Steam Qf, Gas Qn, Gas M, Gas Qf, Liq Qf, Liq M			R&W	B04
		Fluid Conds.					
			(When fluid is Steam M, Gas M, Liq M)				
			Density f			R&W	B14
			Unit type	kg, ton, lb		R&W	B15
			(When fluid is Steam H)				
			Density f			R&W	B19
			Enthal. unit	kcal/kg, kJ/kg, Btu/lb		R&W	B20
			Enthal Value			R&W	B21
			Unit type	kcal, Mcal, kJ, MJ, BTU		R&W	B22
			(When fluid is Gas Qn)				
			Temp n			R&W	B25
			Pressure f			R&W	B26
			Pressure n			R&W	B27
			Devisation			R&W	B28
			Unit type	NM3, NL, SCF		R&W	B29
			(When fluid is Steam Qf,Gas Qf, Liq Qf)				
			Unit type	M3, L, ACF, Usgal, UKgal		R&W	B35
		Time unit	s, min, h, d			R&W	B50
		Span				R&W	B52
		User orig. unit	Unit conv. factor			R&W	C09
			User unit			R&W	C10
	Signal Processing	Sensor info.	Frequency			R	G01
			Velocity			R	G03
			Span freq.			R	G02
			Reynolds No.			R	G05
			Fluctuation	Fluctuation control	Not active, Active	R&W	G20
				Max flow		R	G21
				Min flow		R	G22
		Compensation	Reynolds	Reynolds adjust	Not active, Active	R&W	D01
				Reynolds No.		R	G05
				Density f		R&W	D03
				Viscosity		R&W	D02
			Pipe effect	Not active, Wafer Sch 10, Wafer Sch 40, Wafer Sch 80, Flange Sch 10, Flange Sch 40, Flange Sch 80		R&W	D05

Menus						R/W	BRAIN
			Expansion factor	Not active, Active		R&W	D06
			Flow comp. control	Not active, Active		R&W	D20
				(When "Active")			
				Set pt. 1 data	F1	R&W	D21
					D1	R&W	D22
				Set pt. 2 data	F2	R&W	D23
					D2	R&W	D24
				Set pt. 3 data	F3	R&W	D25
					D3	R&W	D26
				Set pt. 4 data	F4	R&W	D27
					D4	R&W	D28
				Set pt. 5 data	F5	R&W	D29
					D5	R&W	D30
		Service	Noise bal.			R&W	H01
			T.L.A.			R&W	H02
			Gain			R&W	H03
			H.F. Filter			R&W	H04
			Noise judge	Not active, Active		R&W	H06
			Low cut			R&W	H07
			Clear Err 2	Not active, Active		R&W	H10
			Measure TP2	Measure TP2 Control	Not active, Active	R&W	H20
				TP2 Volt		R	H21
	Output setup	PV Damp				R&W	B53
		Output select	Analog out, Pulse out			R&W	B02
		Analog out.	A01			R	
			AO Alrm typ	Lo		R	
			Loop test	4mA, 20mA, Other			F01
			Calibration	D/A trim	4mA		H08
					20mA		H09
				Scaled D/A trim	for 4mA for 20 mA		
		Pulse output	Pulse scale	E0 to +/-E5, UNSC*1, *10, *100		R&W	C02
			Pulse test				F02
		Totalizer	Total			R	A30
			Total Reset	Exit, execute		R&W	E01
				Total scale	E0 to ±E5, UNSC*1, *10, *100	R&W	C01
		HART output	Poll addr.	0-15		R&W	
			Num req. preams			R	
			Burst mode	Burst option	PV, % rnge/curr, Process vars/crnt	W	
				Burst mode	Off, On	W	
		LCD output	Display select	%rnge, PV, Total, %rnge & Total, PV & Total, %rnge &		R&W	E02

Appendix B: HART Parameter Details

Menus								R/W	BRAIN
						PV			
					PV Display scale	E0 to ±E5		R	
				Device into	Manufacturer			R	
					Tag			R&W	B02
					Descriptor			R&W	M01/M02
					Message			R&W	
					Date			R&W	
					Dev id			R	
					Write protect			R	
					Revision #'s	Universal rev.		R	
						Fld dev rev		R	
						Software rev		R	
						Hardwre rev		R	
				Service into.	Not open				
			Review	Review 1	...See Note 5			R	
				Review 2	...See Note 5			R	
				Review 3	...See Note 5			R	
	PV							R	A20
	PV AO							R	
	PV URV							R&W	B52
	Mode	Factory						R	

Appendix B: HART Parameter Details

Note 1: R = read, W = write
Note 2: Shows corresponding BRAIN parameter. See Appendix A for details on parameter data range and help.

Note 3:	Note 4:	Note 5:	
New Device	Status	Review 1	Review 3
Output select	EEPROM	Model	Span f
Line size	N.J. circuit error	Manufacturer	Span v
Fluid	No device ID	Distributor	Reynolds adjust
K-factor unit	Span set error	Tag	Viscosity
K-factor value		Descriptor	Density f
Density unit		Message	Pipe effect
Min. density		Date	Expansion fact
Temp unit		Dev id	Flw comp. cntrl
Temperature f		Write protect	Fluctuation cntrl
Flow unit type 1		AO alarm type	Noise balance
Flow unit type 2		Universal rev	T.L.A.
Flow unit type 3		Fld dev rev	Gain
Flow unit type 4		Software rev	H.F. filter
Base time unit		Hardware rev	Noise judge cntrl
Span value		Poll address	Low cut flowrate
Density f		Burst mode	Clear err-2
Enthalpy unit		Num req preams	Meas. TP2 cntrl
Enthalpy value			
Temperature n		Review 2	
Pressure f			
Pressure n		PV unit	
Deviation		Span	
PV damp		PV damp	
Total scale		Output select	
Pulse scale		Line size	
Unit conv. factor		Fluid	
User uinit		K-factor value	
Tag		Min. density	
Descriptor		Temp f	
Message		Total scale	
Date		Pulse scale	
		Unit conv. factor	
		Display select	
		PV display scale	

INDEX

Symbols

A

B

C

D

E

F

G

H

I

J

K

L

N

O

P

Q

R

S

T

V

W

Y

Z