SPARLING INSTRUMENTS, INC.

INSTRUCTION DATA SHEET

SERIES 100
METERS AND
ACCESSORIES

FT193 TRANSMITTER

IDS–193
Issue Date: Sept. 1992
Supercedes: Feb. 1987

1. DESCRIPTION.

The FT193 Transmitter utilizes a chopper wheel and photo pickup to provide both a 4-20 mA DC current signal and a scaled pulse output directly proportional to flow rate to operate remotely located indicators, totalizers, recorders and controllers. In addition, the 193 provides a 6 digit direct reading flow totalizer that operates independent of the electrical signal outputs.

Basic scaling is done by the selection of gears. Contact the factory for assistance.

2. DISASSEMBLY AND REMOVAL OF TRANSMITTER MECHANISM

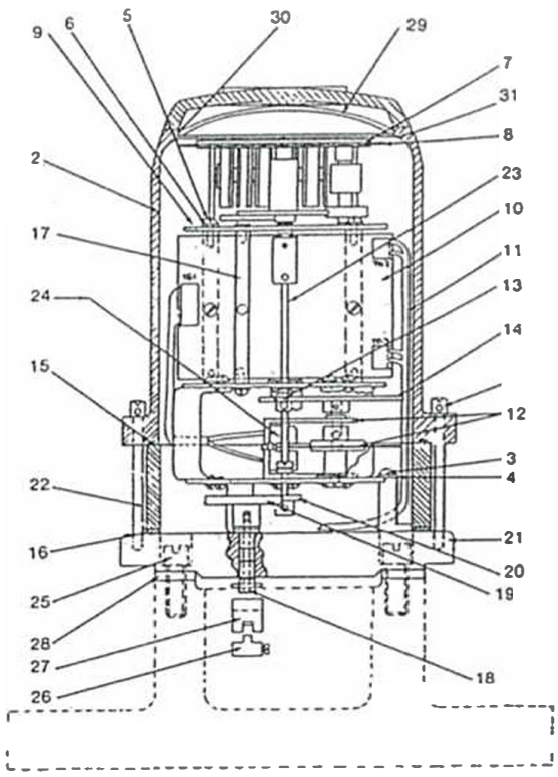
a. Remove the six bonnet screws (1) securing bonnet assembly (2) to mounting base (21). Remove bonnet assembly. To troubleshoot electronics no further disassembly is required.

b. Remove three mechanism mounting screws (3) and washers (4) securing mechanism to mounting base (21). Lift out mechanism.

c. Dissemble transmitter mechanism as required in accordance with Figure 1.

3. TEST AND CALIBRATION

3.1 Equipment Required:
Sparling Model 702 Pulse Calibrator
3 1/2 digit digital ammeter
Adaptor plug (optional) or jumper with alligator clips.
DC voltage supply between 18 and 30 volts (for bench testing)



REMOVE SCREWS (1) TO GAIN ACCESS TO TRANSMITTER MOUNTING SCREWS (25) FOR TRANSMITTER REMOVAL OR INSTALLATION.

1. Screw, Bonnet Mounting
2. Bonnet Assembly
3. Screw, Mechanism Mounting
4. Washer, Mechanism Mounting
5. Screw
6. Washer
7. Dial, Register
8. Plate, Backing Dial
9. Register Clock Assembly
10. P.C. Board Assembly
11. Cable Assembly
12. Frame and Chopper Wheel Assembly
13. "A" Switch Gear Assembly
14. "B" Switch Gear Assembly
15. Seal, O-Ring
16. Seal, Flat Gasket
17. Standoff
18. Shaft Assembly, Main Drive
19. "A" Change Gear Assembly
20. "B" Change Gear Assembly
21. Base, Mounting
22. Spacer Assembly
23. Shaft, Extension
24. Photocoupler and Cable Assembly
25. Screw, Transmitter Mounting
26. Clevis Male
27. Clevis Female
28. Gasket
29. Glass
30. O Ring
31. Gasket

Figure 1.

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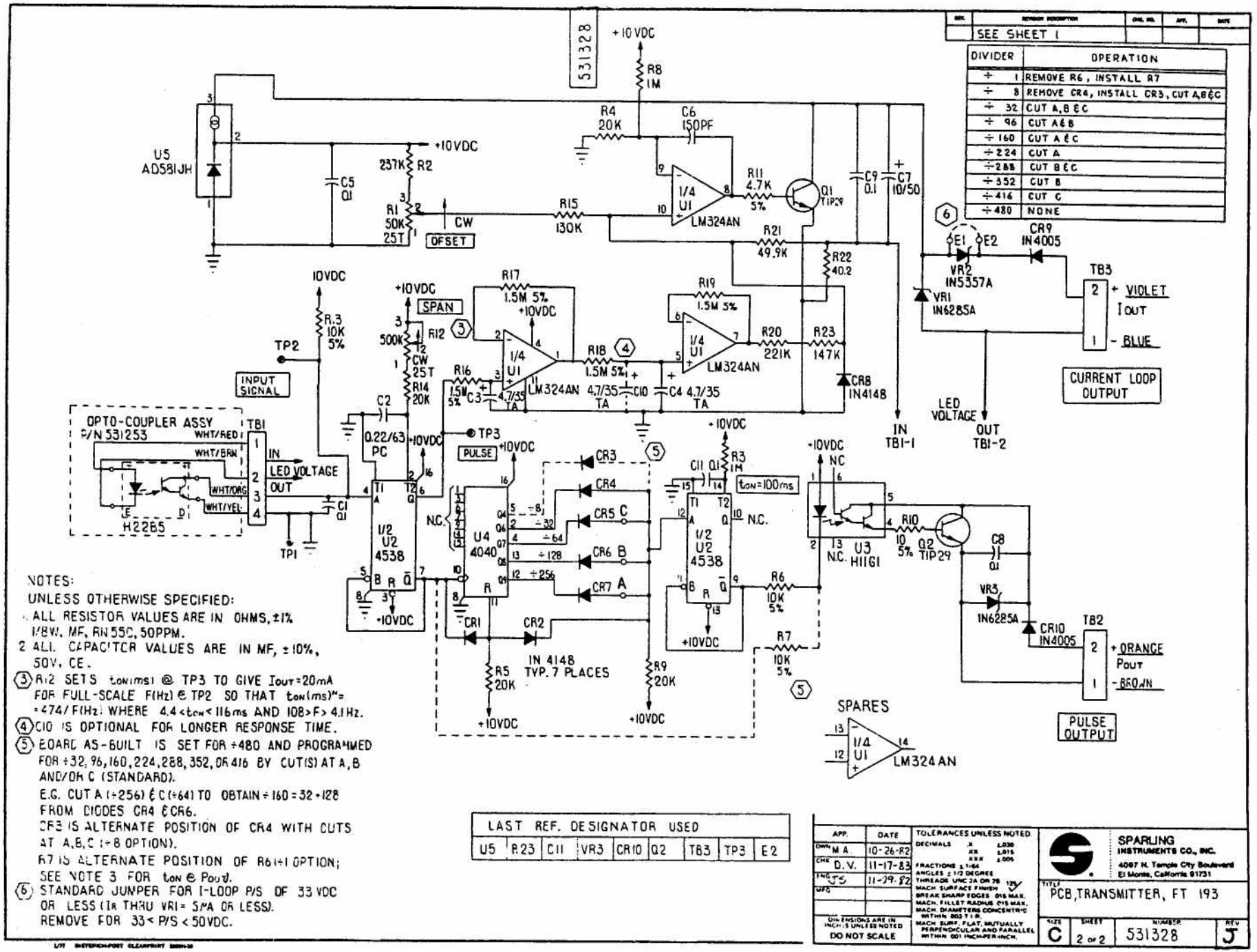

NOTES:
UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTOR VALUES ARE IN OHMS, ±1% 1/8W, MF, RN55C, 50PPM.
2. ALL CAPACITOR VALUES ARE IN MF, ±10%, 50V, CE.
3. R12 SETS t_{ON}(ms) @ TP3 TO GIVE I_{OUT}=20mA FOR FULL-SCALE F(Hz) @ TP2 SO THAT t_{ON}(ms)≈ =474/F(Hz) WHERE 4.4<t_{ON}<116ms AND 108>F>4.1Hz.
4. C10 IS OPTIONAL FOR LONGER RESPONSE TIME.
5. BOARD AS-BUILT IS SET FOR ÷480 AND PROGRAMMED FOR ÷32, 96, 160, 224, 288, 352, OR 416 BY CUT(S) AT A, B AND/OR C (STANDARD).
   E.G. CUT A (÷256) & C (÷64) TO OBTAIN ÷160 = 32 ÷128 FROM DIODES CR4 & CR6.
   CR3 IS ALTERNATE POSITION OF CR4 WITH CUTS AT A, B, C (÷8 OPTION).
   R7 IS ALTERNATE POSITION OF R6 (÷1 OPTION; SEE NOTE 3 FOR t_{ON} & P_{OUT}).
6. STANDARD JUMPER FOR 1-LOOP P/S OF 33 VDC OR LESS (IF THRU VR1 = 5MA OR LESS). REMOVE FOR 33< P/S < 50VDC.

LAST REF. DESIGNATOR USED							
U5	R23	C11	VR3	CR10	Q2	TB3	TP3	E2

APP.	DATE
DWN M A	10-26-82
CHK D.V.	11-17-83
ENG JS	11-29-82
MFG	

DIMENSIONS ARE IN INCHES UNLESS NOTED. DO NOT SCALE

TOLERANCES UNLESS NOTED: DECIMALS .X ±.030, .XX ±.015, .XXX ±.005; FRACTIONS ± 1/64; ANGLES ± 1/2 DEGREE; THREADS UNC 2A OR 2B; 125 MACH. SURFACE FINISH; BREAK SHARP EDGES .015 MAX.; MACH. FILLET RADIUS .015 MAX.; MACH. DIAMETERS CONCENTRIC WITHIN .003 T.I.R.; MACH. SURF. FLAT, MUTUALLY PERPENDICULAR AND PARALLEL WITHIN .001 INCH-PER-INCH.

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TITLE: PCB, TRANSMITTER, FT 193

SIZE	SHEET	NUMBER	REV
C	2 OF 2	531328	J

3.2 Preliminary Calculations

3.2.1 If the meter record or meter I.D. label states the (whole) number of Hertz (PPS) to produce calibration current in the range of 18-22 mA, proceed directly to step 3.3.

3.2.2 If the meter record states full scale input frequency, F, (e.g. 23.2 Hz) at 20 mA output, calculate calibrator values as follows:

3.2.2(a) Round off the full scale frequency to the nearest integer to obtain F cal. (e.g. F=23.2 Hz, Fcal =23 Hz.)

3.3.3 (b) Calculate Ical produced when 702 calibrator is set to Fcal:

$I\,cal = (16 \times F\,cal)/F + 4\ mA$

ex: $I\,cal = (16 \times 23)/23.2 + 4\ mA$

$= 19.862\ mA$

3.2.2(c) (Optional) Calculate T = time between totalizer clicks while on 702 calibrator:

$T = (60 \times R \times F) / (Q \times F\,cal)$ in seconds

where:

R = Output registration (Gal/pulse)

Q = FS flow rate (GPM)

Fcal = Calibrator frequency (Step 3.2.2(a))

ex. R = 100 Gal/Pulse; Q = 600 GPM; Fcal = 23 Hz; F = 23.2 Hz

$T = (60 \times 100 \times 23.2) / (600 \times 23)$

$= 10.1$ sec/pulse

3.3 CALIBRATION OF 4-20 mA OUTPUT

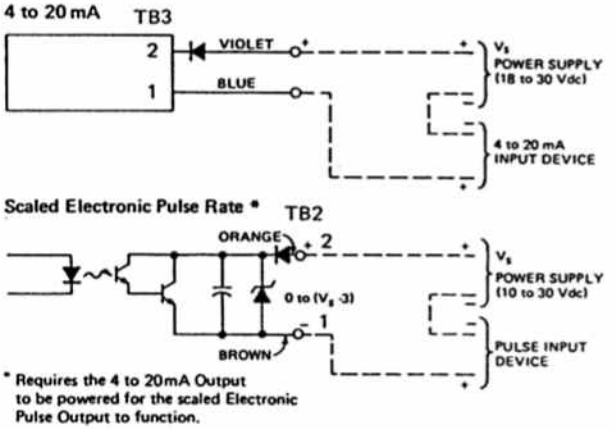

Figure 2.

3.3.1 For bench testing, remove pcb from meter and power up 4-20 mA loop (TB3 on PCB) with external DC power supply in series with current DVM.

3.3.2 For field testing, remove meter bonnet and insert DVM in 4-20 mA loop (violet and blue wires). Unplug chopper wheel harness plug at four-position TB1 on the PCB by gently rocking the plug (avoid excessive force).

3.3.3 Install polarized adapter plug in TB1 or jumper together pins 1 and 2 of TB1 (pin 1 is topmost, nearest pot R1).

3.3.4 Connect 702 calibrator as follows:

+9 V PULSE to TB1, pin 3 (or test point TB2)

"GROUND" to TB1, pin 4 (or test point TP1)

3.3.5 With calibrator "OFF", verify DVM reading of 4.00 mA ±0.02 mA. Adjust "OFFSET" pot R1 (just above TB1) if necessary.

3.3.6 Set calibrator to Fcal (see step 3.2.1 or 3.2.2.(a)) and turn switch to "ON". After current stabilizes (typically 2-3 minutes), verify that DVM reads Ical ±0.02 mA. If necessary, make small adjustments to "SPAN" pot R12 (just below TB1) waiting each time for current to stabilize.

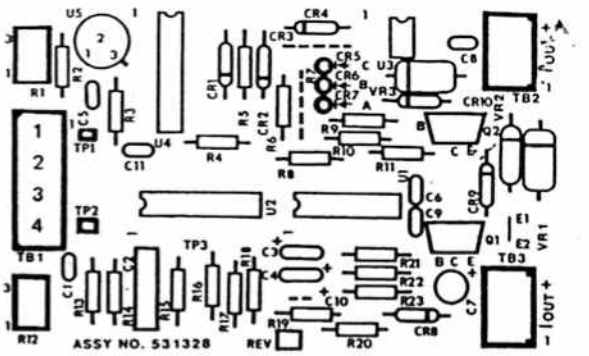

Figure 3.

3.3.7 Repeat steps 3.3.5 and 3.3.6 as necessary.

3.4 VERIFICATION OF PULSE OUTPUT SCALING (OPTIONAL)

3.4.1 Perform steps 3.2.2(c) and 3.3.1 through 3.3.4. (See wiring diagram figure 2 for wiring detail of outputs if bench testing).

3.4.2 Set calibrator to Fcal and turn to "ON". Use watch to verify time between counts as calculated in step 3.2.2(c). For greater accuracy, measure time between 10 counts (e.g. 9.9 sec between counts or 99 sec between 10 counts).

4. RESCALING

The current output may be rescaled by adjusting the span pot if the new full scale flow rate is still within the accuracy limits of the meterhead and the pulse registration is not changed. Changing pulse registration requires change of gears. Contact the factory for assistance.

4.1 Obtain from the meter record the old f.s. input frequency, F_{old} (in Hz) for the original flow rate, Q_{old} (GPM).

4.2 Calculate F_{new} for the desired flow rate, Q_{new} (GPM).

$F_{new} = F_{old} \times Q_{new} / Q_{old}$

ex. $F_{old} = 23.2$ Hz; $Q_{old} = 600$ GPM; $Q_{new} = 1000$ GPM

$F_{new} = 23.2 \times 1000/600 = 38.667$

4.3 Use this value F_{new} in place of F and perform steps 3.2.2(a), and (c) to obtain Fcal, Ical and T values.

4.4 Follow proceedure in 3.3 and 3.4 to complete rescaling. Mark the meter record and its label accordingly.

5. TROUBLESHOOTING

Follow the troubleshooting chart figure 4. When replacing the pcb, make sure the new pcb is scaled the same way (see section 3). In particular, verify that end mounted diodes CR5,6, and 7 are programmed by cuts the same way as on the old pcb (refer to schematic, 531328 Table 1 for programming pulse output divider section of pcb).

6. ASSEMBLY AND INSTALLATION

a. After assembling the transmitter mechanism, pivot the frame and chopper wheel assembly (12) to bring switch "B" gear (14) into mesh with switch "A" gear (13). Check vertical alignment of gears. Make certain that the gears are not in contact merely at the tips of the teeth, nor too tightly meshed. Spin the gears to check for possible binding.

b. Secure the mechanism to base (21) with three mounting screws (3) and washers (4), making sure that "B" change gear (20) meshes with "A" change gear (19) prior to tightening the screws.

c. A small amount of backlash should exist between the meter drive gear and the driven gear. Recheck backlash in several positions of rotation.

d. Install gasket (16), spacer assembly (22) and bonnet (2). Secure bonnet to mounting base (21) with six screws (1).

	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
1.	No outputs (not even 4mA output and no pulse output)	No power to meterhead.	Disconnect violet and blue output leads from external wires. Measure voltage across external wires. It should be between 18 and 30 Vdc. Provide proper power.
		Power supply leads reversed.	
		Printed circuit board failure.	Replace printed circuit board.
2.	4-20mA output is fixed at some value higher than 5mA regardless of flowing condition. May be > 20mA	External power supply too large.	Disconnect blue and violet output leads from external wires. Measure voltage across external wires. Voltage should be between 18 and 30 Vdc. Provide proper power.
		Output leads reversed.	Check to insure (+) terminal of external power supply is connected to violet output lead.
		Printed circuit board failure.	Replace printed circuit board.
3.	4-20mA output responds to flow, but pulse output does not respond	Pulse output leads not properly wired.	Insure pulse output leads are properly connected with correct polarity (Hi-orange Lo-Brown) and have continuity to output device and external power.
		Printed circuit board failures.	Replace printed circuit board.
4.	Pulse output responds to flow but 4-20mA output does not respond	4-20mA leads not properly wired.	Insure 4-20mA output leads are properly connected with correct polarity and have continuity to output device and external power.
		Printed circuit board failure.	Replace printed circuit board.
5.	4-20mA output is fixed near 4mA and no output pulses occur under flowing conditions. (Meter does not respond to flow)	Flow is below the range of the meterhead.	Increase flow rate to get output.
		Printed circuit board failure.	Replace printed circuit board.
6.	Both outputs function but respond to flow inaccurately	Not properly calibrated.	Follow Section 3 (Test and Calibration).
		Printed circuit board failure.	Replace printed circuit board.

Figure 4.

PART NUMBERS FT 193 TRANSMITTER PARTS

ITEM	DESCRIPTION	PART NUMBER
1	Screw, Bonnet Mounting	121632
2	Bonnet Assy	524183
3	Screw, Mechanism Mounting	108218
4	Washer , Mechanism Mounting	134239
5	Screw	107913
6	Washer	101551
7	Dial, Register	512881
8	Plate, Backing Dial	516437
9	Register Clock Assy (1:1 Ratio)	512443
9	Register Clock Assy (5:1 Ratio)	516271
9	Register Clock Assy (10:1 Ratio)	528515
10	P.C. Board Assy	531328
11	Cable Assy	510603
12	Frame & Chopper Wheel Assy	540973
13	"A" Switch Gear Assy (Specify Number of Teeth)	118069
14	"B" Switch Gear Assy (Specify Number of Teeth)	130013
15	Seal, O-Ring	100660
16	Seal, Flat Gasket	138299
17	Standoff	531245
18	Shaft Assy, Main Drive	509838
19	"A" Change Gear Assy 5 thru 16 Teeth	131110
19	"A" Change Gear Assy 17 - 45 Teeth	117342
20	"B" Change Gear Assy @ least 14 Teeth	118069
21	Base, Mounting	531196
22	Spacer Assy	509846
23	Shaft, Extension	509812
24	Photocoupler & Cable Assy	531253
25	Screw, Transmitter Mounting	101238
26	Clevis Male	519556
27	Clevis Female	519697
28	Gasket	521361
29	Glass	502212
30	O-Ring Glass Seal	100826
31	Gasket	505034