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OPERATING MANUAL TOTALIZER



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(a) UNPACKING THE TOTALIZER

a.1 Inspect Package for External Damage

Your Totalizer was carefully packed in a sturdy cardboard carton, with anti-static cushioning materials to withstand shipping shock. Upon receipt, inspect the package for possible external damage. In case of external damage to the package contact the shipping company immediately.

a.2 Unpack the TOTALIZER

Open the carton carefully from the top and inspect for any sign of concealed shipping damage. In addition to contacting the shipping carrier please forward a copy of any damage report to your distributor or Aalborg® directly.

When unpacking the instrument please make sure that you have all the items indicated on the Packing List. Please report any shortages promptly.

a.3 Returning Merchandise for Repair

Please contact the customer service representative of your distributor or Aalborg® if you purchased your Totalizer directly, and request a **Return Authorization Number (RAN)**. **Equipment returned without an RAN will not be accepted.** Aalborg® reserves the right to charge a fee to the customer for equipment returned under warranty claims if the instruments are tested to be free from warranted defects.

Shipping charges are borne by the customer. Items returned "collect" will not be accepted!

It is mandatory that any equipment returned for servicing be purged and neutralized of any dangerous contents including but not limited to toxic, bacterially infectious, corrosive or radioactive substances. No work shall be performed on a returned product unless the customer submits a fully executed, signed SAFETY CERTIFICATE. Please request form from the Service Manager.

(b) DESCRIPTION

MODEL TOT-10: Totalizer designed to be used with existing models of GFM mass flow meters and GFC mass flow controllers (calibrated for given flow rate specified on the back label). It can be connected to the modular jack instead of the LCD display, or optionally with the additional connector (CBL-TOT-10) in parallel with the LCD display. Mechanically TOT-10 can be installed on the top of the LCD display with two brackets and screws (supplied only for model TOT-10).

MODEL TOT-05: Totalizer designed to be used with any transducer which has 0 to 5 Vdc output signal and time based engineering units. (i.e. units per second, units per minute, units per hours) It has to be connected to 12 Vdc power source and 0 to 5Vdc voltage source with additional cable. It is calibrated for given flow rate specified on the back label.

(c) FEATURES

The Totalizer takes analog output flow signals of 5 to 10 Vdc from the GFM or the GFC models, or 0 to 5 Vdc from other transducers. It integrates and accumulates up to 7 digits of direct engineering units for the given gas and flow rate (i.e. standard liters, standard cubic centimeters, etc.). In order to reduce low signal (noise) totalizing, provision is made for 1% cut off schematic which allows to accumulate only flow rates which exceeded 1% F. S.

(d) SPECIFICATIONS

d.1 General Attributes

INPUT ANALOG RANGE: 5 to 10 VDC or 0 to 5 VDC jumper selectable.

POWER SUPPLY REQUIREMENTS:

12Vdc, 100mV Pk-Pk, less than 0.5 watts.
(OPTIONAL, require only for TOT-05).

POWER CONSUMPTION: 10 mA at 12 VDC, less than 0.125 watts.

ACCURACY: $\pm 0.5\%$ of full scale.

TEMPERATURE STABILITY: ± 200 ppm/ °C in the range of 5 °C to 50 °C.

DISPLAY: 7 digit, 8-mm figure height.

READING BACKUP: 20 years lithium battery, no external power required.

RESET: Front panel push button momentary tact switch
(works only when Totalizer is connected to the power).

ALTITUDE: Up to 10,000 feet.

CONNECTION METHOD: Telephone modular plug.

d.2 CE Compliance

Any model Totalizer bearing a CE marking on it, is in compliance with the below stated test standards currently accepted.

EMC Compliance with 89/336/EEC as amended;

Emission Standard: EN 55011:1991, Group 1, Class B

Immunity Standard: EN 55082-1:1992

Environmental (per IEC 664): Installation Level II; Pollution Degree II

(e) ELECTRICAL CONNECTIONS

e.1 Connector Pin Assignments

All connections are made at connector J1 (telephone modular plug). Models TOT-10 can be connected directly to the GFM or GFC. Model TOT-05 have to be connected with optional cable with stripped wires as described below:

- T1 (Yellow) - Analog input 0 to 5Vdc from transducer.
- T2 (Green) - 5.0Vdc reference input (used only for TOT-10).
- T3 (Black) - 12Vdc Power Supply input.
- T4 (Red) - Power supply return (GND), analog input return (Common).



CAUTION: Exceeding the following voltages will cause device failure and/or hazardous conditions to exist:

TERMINAL NUMBER	MAXIMUM VOLTAGE (VDC)	MODE
T1 (YELLOW)	16	Voltage Input
T2 (GREEN)	16	Reference Voltage Input
T3 (BLACK)	16	Power Input



CAUTION: Make sure power is OFF when connecting or disconnecting any cables in the system.

e.2 Jumper Assignments

JP1 - Division factor jumper (has to be installed during calibration, See Calibration procedure).

- Pins [1] and [2] select division 10
- Pins [3] and [4] select division 100
- Pins [5] and [6] select division 1000
- Pins [7] and [8] select division 10000

JP2 - Input mode jumper

- Pins [1] and [2] select 0 - 5VDC INPUT mode model TOT-05.
- Pins [2] and [3] select 5 - 10 Vdc input mode model TOT-10.



CAUTION: Improper setting of jumpers may result in incorrect operation of the unit and could cause damage to the Totalizer.

(f) CALIBRATION PROCEDURE

f.1 Equipment Required for Calibration

You will need:

1. Two 4-1/2" digit Digital Multi Meters set to the selected analog output range and frequency.
2. For TOT-10: GFM mass flow meter or GFC mass flow controller with power supply.
3. For TOT-05: Any transducer with 0-5 Vdc output and time based engineering units and +12Vdc power supply.

f.2 Calibration

Each Totalizer is shipped from the factory with GAIN, OFFSET, SCALE and DIVISION FACTOR adjustments made for a given flow rate (see Table 2). If full scale range for Totalizer was not specified on the back label it was by default adjusted for 30 unit/min which corresponds to SCALE 5.00 kHz and DIVISION 1000. In this case the Totalizer has to be re-scaled for the desired full scale range (see f.4). Internal timing schematic GAIN and OFFSET is adjusted in the factory and does not require additional readjustment when re-scaling Totalizer for different flow ranges or engineering units. The GAIN and OFFSET adjustment procedure (see f.3) must be performed only if the potentiometer R12 (GAIN) was accidentally readjusted.

Choose from TABLE 1 the option which better matches your case:

TABLE 1		
1	If Totalizer has label with corresponding flow rate on the back and you do not plan to change the full scale range.	The Totalizer is ready for use and does not require any adjustment.
2	If Totalizer has label with corresponding flow rate on the back and you do plan to change the full scale range.	Refer to f.4 RE-SCALING OF TOTALIZER
3	If Totalizer does not have label with corresponding flow rate on the back (default calibration for 30 unit/min) and you do plan to change the full scale range.	Refer to f.4 RE-SCALING OF TOTALIZER
4	⚠ Use this option only if the potentiometers R12 (GAIN) or R19 (OFFSET) were accidentally readjusted.	<ol style="list-style-type: none"> 1. Refer to f.3 and perform GAIN ADJUSTMENT 2. Refer to f.4 and perform RE-SCALING OF TOTALIZER for desired flow range.

f.3 GAIN Adjustment (required only if potentiometer R12 GAIN was accidentally readjusted)

1. Carefully remove front panel from the Totalizer.
2. Set potentiometer R8 (SCALE) into completely up position (CW direction).
3. Connect the Totalizer to the transducer (see e.1).
4. Using a digital multimeter connected to the 0 to 5 Vdc signal at the output of transducer, set the output rate on the transducer to full scale (5 Vdc). Connect a second digital multimeter with selected frequency function (resolution of 4-1/2 digit is required) to pin [T5] on the Totalizer printed circuit board. Maintain full scale flow (5000 mV output from transducer) and adjust the potentiometer R12 (GAIN) for frequency reading of 5.000 kHz ± 10 Hz.
5. Maintain 2% full scale flow (100 mV output from transducer) and adjust the potentiometer R19 (OFFSET) for frequency reading of 100 Hz ± 2 Hz.
6. Maintain again full scale flow (5000 mV output from transducer) and adjust the potentiometer R12 (GAIN) for frequency reading of 5.000 kHz ± 10 Hz.

f.4 Re-Scaling of Totalizer (if necessary)

It may be desirable to re-scale the Totalizer for different flow ranges or engineering units.

To change flow range:

1. Calculate the Fs factor which is flow rate specified in UNIT/SEC. (i.e. standard liters per second [L/sec.], standard cubic centimeters per second [mL/sec], etc.)

$$F_s = F_m/60;$$

where:

Fm = Full scale range in [UNIT/MINUTE] for which your transducer has been calibrated (usually shown on the front label). If engineering unit is not minute based it has to be converted. For example 300 SCFH has to be converted to $300/60 = 5$ cubic feet/minute.

2. Choose scale factor V_s and division factor D from Table 2 which correspond to your previously calculated F_s .
3. Connect the Totalizer to the transducer (see e.1)
4. Carefully remove front panel from the Totalizer. Using the digital multi meter connected to the 0 to 5 Vdc signal at the output of transducer, set the flow rate on the transducer to the full scale flow (5 Vdc). Connect the second digital multimeter with selected frequency function (resolution of 4 1/2 digit is required) to pin [T5] on the Totalizer printed circuit board. Maintain full scale flow and adjust the potentiometer R8 (SCALE) for frequency reading equal to V_s . For example if you have a transducer with full scale flow range of $F_m = 6 \text{ L/Min}$, your $F_s = 6/60 = 0.1$ and from Table 1 the value of $V_s = F_s * 10 = 1 \text{ kHz}$.
5. Install jumper JP1 into a position which corresponds to your division factor D from Table1. For previous example, $D = 10000$ and the jumper has to be installed for pins [7] and [8] JP1.

TABLE 2					
F_m - FULL SCALE RANGE IN [UNIT/MINUTE]					
F_m [unit/min]	0.3 to 3.0	3 to 30	30 to 300	30 to 3000	> 3000
F_s [unit/sec.]	0.005 to 0.05	0.05 to 0.5	0.5 to 5.0	5.0 to 50	> 50
V_s [kHz] Scale Factor	$F_s * 100$	$F_s * 10$	F_s	$F_s / 10$	$F_s / 100$
D Division Factor	10000 JP1 7-8	10000 JP1 7-8	1000 JP1 5-6	100 JP1 3-4	10 JP1 1-2
Output Unit	[unit]	[unit]	[unit]	[unit]	[unit]

(g) TROUBLE SHOOTING

Your Totalizer was thoroughly checked at numerous quality control points during and after manufacturing and assembly operations. It was calibrated in accordance to conditions for a given.

It was carefully packed to prevent damage during shipment. Should you feel that the instrument is not functioning properly please check for the following common conditions first:

Are all cables connected correctly?

Is the power supply correctly selected according to requirements? When several meters are used a power supply with appropriate current rating should be selected.

Were the connector pinouts matched properly? When interchanging with other manufacturers equipment, cables and connectors must be carefully wired for correct.

For best results it is recommended that instruments are returned to the factory for servicing. See section a.3 for return procedures.



CAUTION: Use of the TOTALIZER in a manner other than that specified in this manual or in writing from Aalborg®, may impair the protection provided by the equipment.

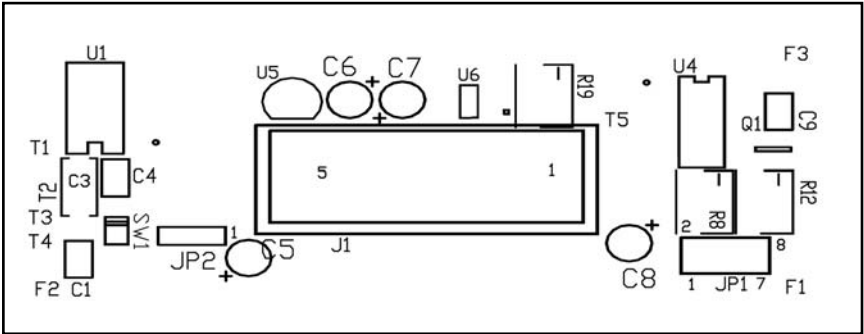
APPENDIX 1

GLOSSARY

- Fm** Full scale range in [UNIT/MINUTE] for which your transducer has been calibrated (usually shown on the front label). If engineering unit is not minute based it has to be converted. For example 300 SCFH has to be converted to $300/60 = 5$ cubic feet/minute.
- Fs** Full scale range specified in UNIT/SEC.
- Vs** SCALE FACTOR in kHz which corresponds output frequency for given flow rate (see Table 2).
- D** DIVISION FACTOR corresponds division of the output frequency for particular flow rate (see Table 2).

APPENDIX 2

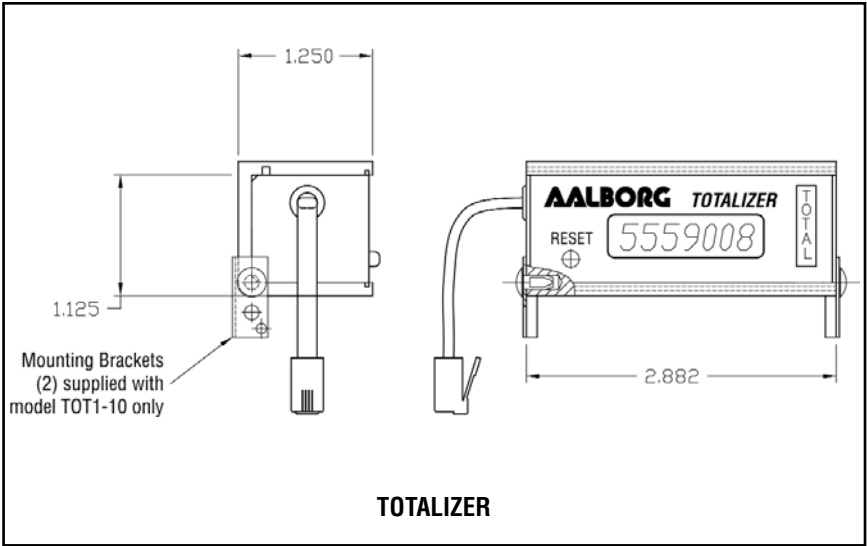
COMPONENT DIAGRAM



R19- OFFSET ADJUSTMENT
R12- GAIN ADJUSTMENT
R8-SCALE ADJUSTMENT

APPENDIX 3

DIMENSIONS



NOTE: Aalborg® reserves the right to change designs and dimensions at its sole discretion at any time without notice. For certified dimensions please contact Aalborg®.

APPENDIX 4

WARRANTY

Aalborg® Mass Flow Systems are warranted against parts and workmanship for a period of one year from the date of purchase. Calibrations are warranted for up to six months after date of purchase, provided calibration seals have not been tampered with. It is assumed that equipment selected by the customer is constructed of materials compatible with gases used. Proper selection is the responsibility of the customer. It is understood that gases under pressure present inherent hazards to the user and to equipment, and it is deemed the responsibility of the customer that only operators with basic knowledge of the equipment and its limitations are permitted to control and operate the equipment covered by this warranty. Anything to the contrary will automatically void the liability of Aalborg® and the provisions of this warranty. Defective products will be repaired or replaced solely at the discretion of Aalborg® at no charge.

Shipping charges are borne by the customer.

This warranty is void if the equipment is damaged by accident or misuse, or has been repaired or modified by anyone other than Aalborg® or factory authorized service facility. This warranty defines the obligation of Aalborg® and no other warranties expressed or implied are recognized.

NOTE: Follow Return Procedures in Section a.3.