Instruction Manual

ASL-41 Tachometer with Progressive Shift Light

Version 1.0 (May 2014)

1. Features

This multifunctional meter is designed to provide automation solution for a broad range of applications. It can be used as a tachometer, a frequency meter, or a counter. It allows you to activate the relay at a specific frequency or spinning speed. This meter has 3 dedicated terminals to control an external progressive shift light.

2. Specifications

Input signal range	Low: -30V ~ +0.6V; high: +4V ~ +30V
Input sensor type	Optical coupler, proximity sensor, hall sensor, encoder
Power supply	DC 12 ~ 30 V (Isolated)
Power Consumption	< 2 W
Relay contact rating	3A
Relay life	100,000 times
Sampling	1 second; maximum measureable frequency: 50KHz
Display Range	0-9999
Measurement Range	1-9999; 60-9999 RPM; 1-6000Hz
Accuracy	±0.3% of full input range or ±1 unit
LED Display	0.28'' red LED
Dimension	48 x 24 x 65 mm
Mounting Cutout	45 x 22 mm
Working Condition	0~50 ˚C, ≤ 85% RH

3. Front Panel

Figure 1. Front panel of ASL-41.

① LED display window.
② AL alarm indicator.
③ SET key.
④ SHIFT key.
⑤ UP key (increment/reset/dimmer).
⑥ J1 relay indicator.

Descriptions:

1. LED display window. It displays the measured value in Normal Operating Mode or shows the parameter name or value in Parameter Setting Mode.
2. AL light on indicates the alarm is on and J1 relay is pulled in (closed).
3. SET key. In Normal Operating Mode, press SET once, enter the code for a setting mode, press SET again to enter the setting mode. In Parameter Setting Mode, press it to select a parameter or to save the value.
4. SHIFT key (“>”). In Parameter Setting Mode, press this key to select the digit to be changed.
5.UP key (“Λ”). In Parameter Setting Mode, press it to scroll the parameter list or to increase the parameter value. In normal operating mode, press it 2 seconds to clear the current measured value and start a new measurement.
6. J1 relay indicator. The light is on when J1 relay is pulled in (closed).

4. Terminal Assigments

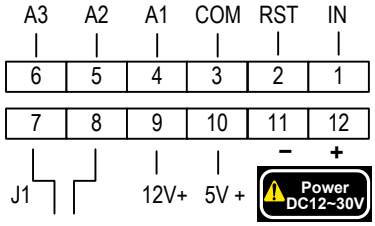

Figure 2. Terminal assignment

4.1 Description of Wiring Terminals (T1 ~ T12)

T1: signal input.
T2: reset. A input signal at this terminal can clear the current measurement and start a new measurement.
T3: common pole for input signal (T1).
T4: output signal A1 to lit LED (use with T3).
T5: output signal A2 to lit LED (use with T3).
T6: output signal A3 to lit LED (use with T3).
T7: output for J1 relay (use with T8).
T8: output for J1 relay (use with T7).
T9: +12V DC power output (use with T11).
T10: +5V DC power output (use with T11).
T11: the ground pole for 12VDC power input (use with T12).
T12: the positive pole for 12VDC power input (use with T11).

4.2 Input Sensor Wiring

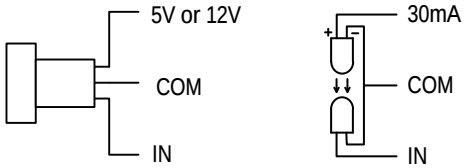

Figure 3. Wiring pins of a proximity sensor (left, note1) and an optical coupler. The proximity sensor wiring above is for a NPN type sensor. Add a 512 ohm resistor between IN and COM for PNP type sensor.

5. Meter Functions and Operations

5.1 Selecting Meter Function (accessed by code 0089)

This meter has 3 measurement functions, which are listed in Table 1. To change the setting, press SET key, change the code to ”0089", then press SET again to enter Parameter Setting Mode. Press “Λ” or “>” key to change the value of the parameter P-Sn. Then, press SET to confirm the change. Press “Λ” or “>” to select “End”, press SET to exit this mode. Please see Figure 4 for a flow chart of how to change the meter function.

Table 1. Parameters of Meter Function.

Symbol	Name	Description	Setting Range	Initial	Note
P-Sn	P-Sn	Meter function	1, 2, 3	1	2
tiME	time	Timer switch	on/off	off	3
unit	unit	Unit of time	S, M, H	S	4
brit	brit	Brightness	1-5	1	5
End	END	Exit			

Note 2. Set “P-Sn” value to 1 to use the meter as a tachometer (unit: RPM); set it to 2 to use it as a frequency meter (Hz); set it to 3 to use the meter as a counter.

Continue:
Note 3. Set "time" value to "on" to enable the build-in timer. The build-in timer will continuously count time whenever the meter is powered on. The time is expressed in the unit which is specified in the "unit" parameter. Power on or off the meter will not erase the value in the timer. The timer can be reset by pressing UP key ("Λ") for two seconds.
Note 4. The unit of time for the timer. It can be set to S (seconds), M (minutes), or H (hours).
Note 5. Dimmed Brightness of the LED display. It can be set between 1 and 5. The higher the value, the brighter the display. The user can switch the brightness level between the regular level and the dimmed level by pressing the Up ("^") key during normal operating mode.

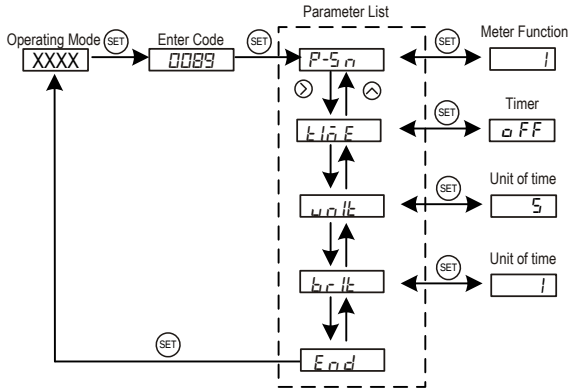

Figure 4. The flow chart for how to set the meter function.

5.2 System Configuration Parameters (accessed by code 0036)

The system configuration parameters are listed in Table 2. Follow the steps below to adjust these parameters:
1) Press SET key, change the code to "0036", press SET again to enter the setting mode.
2) Press "Λ" key to select parameters and press SET to confirm the selection.
3) Change the parameter value using "Λ" key; press SET to save and exit to the parameter list.
4) Press "Λ" to select the new parameter.
5) Exit this mode by selecting End and press SET.
These steps are also illustrated by the flow chart in Figure 5.

Table 2. System Configuration Parameters

Symbol	Name	Description	Setting Range	Initial	Note
FILt	filt	Digital filter	0, 1, 2, 3	0	6
dot	dot	Decimal point	0 - 3	0	7
A	a	Multiplier	-1999 ~ 9999	1	8
b	b	Multiplier	1 ~ 9999	1	8
End	END	Exit			

Note 6. Digital Filter (FILt).Filt = 0, filter disabled; filt = 1, weak filtering effect; filt = 3, medium filtering effect; filt = 3, strongest filtering effect. Strong filter increases the stability of the readout display, but causes more delay in the response to change in reading.
Note 7. The decimal point setting decide how many digits are displayed after the decimal point. This displayed value = measured value / 1 x 10^n (n is the "dot" value). Please note that this setting only affect the resolution of the displayed value.
Note 8. Multiplier a and b. Displayed reading = measured value x (a / b). Setting denominator b to 0 will lead to error with "EEEE" being displayed in the display window.

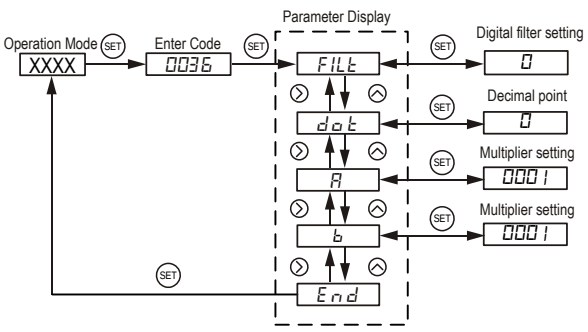

Figure 5. The flow chart for system parameter setting.

5.3 Alarm Settings (accessed by code 0001)

To change the alarm settings, press SET, enter code "0001", press SET again. The parameter setting procedure is similar to the one Figure 5.

5.3.1 Relay setting parameters

The J1 relay is a normally open relay. If AH1 > AL1, J1 relay serves as a high alarm. The relay pulls-in (close) when PV is greater than AH1 (PV > AH1) and it stays closed until PV is less than AL1 (PV < AL1); if AH1 < AL1, J1 relay serves as a low alarm. The relay pulls-in (close) when PV is less than AH1 (PV<AH1), and it stays closed until PV is greater than AH1 (PV>AL1). The gap between AH1 and AL1 is equivalent to hysteresis band. See figure 6 (a) and (b).

5.3.2 External Alarm Signal Parameters

This meter has 3 terminals (T4, T5, and T6) designated to external alarm signals. Each terminal is associated with a triggering value respectively (A1, A2, and A3). The triggering values must satisfy A1 < A2 < A3. When PV < A1, no terminal is activated; when A1 < PV < A2, terminal T1 is activated; when A2 < PV < A3, terminal T2 is activated; when A3 < PV, terminal T3 is activated. The external alarm can be LED lights of difference colors or buzzers. Terminal T4, T5, or T6 should be used with T9 or T10 which provides 12V or 5V DC power to the alarm unit. A wiring diagram of using T4-T6 to activate LEDs of different colors to response to the change of measured value is given in section 6.4.

Table 3. Alarm Parameters.

Symbol	Name	Description	Range	Initial	Note
AH1	AH1	High alarm, J1 relay close	-1999 ~ 9999	600	8
AL1	AL1	Low alarm, J1 relay open	-1999 ~ 9999	400	8
A1	A1	T4 activation	1 ~ 9999	1000	9
A2	A2	T5 activation	A1 ~ 9999	2000	9
A3	A3	T6 activation	A2 ~ 9999	3000	9
AC	AC	Hysteresis band for A1, A2, and A3.	0 ~ 9999	3	10
End	End	Exit			

Note 8. The values of AH1 and AL1 together can decide whether the J1 is set as a high alarm or a low alarm. See section 5.3.
Note 9. The triggering values must satisfy 0 < A1 < A2 < A3 < 9999.
Note 10. Terminal T4, T5, or T6 will be deactivated when PV is greater than Ax – AC, where x = 1, 2, or 3.

6 Application Examples

6.1 Measuring Revolutions Per Minute (RPM)

Set meter type to tachometer, P-Sn = 1. If the meter receives 1 pulse per revolution, then the minimum measurable value is 60 rpm. If the speed is less than 60 rpm, you need to install an uniform distributed gear on the axis, and set the decimal point, multiplier A and b to appropriate values (see Table 4) to get the expected reading.

Table 4. Measurable RPM Values at Different Settings

Pulses per revolution	Multiplier A	Multiplier b	Dot	Minimum measurable RPM	Maximum measurable RPM
1	1	1	0	60	9999
1	1	1	1	60	999.9
2	1	2	1	30	999.9
10	1	10	0	6	9999

6.2 Display the Linear Velocity

Set meter type to tachometer, P-Sn = 1. The linear velocity is calculated from the measured RPM value according to the equation (1):

$$V = N\pi r / (30\ p), \qquad (1)$$

where V is the linear velocity (unit: meter/second), N is the measured speed of revolution (unit: revolution per minute), r is the radius (unit: meter), and p is the number of pulses per revolution

To display the velocity based on the measured revolution speed, set multiplier A and b so that they satisfy the expression (2):

$$A/b = \pi r / (30p), \quad (2)$$

where A and b must be integers.

If you want to improve the display resolution, you can shift the decimal point n digits toward the left and multiply A/b by 10^n. Similarly, shifting the decimal point n digits to the right and multiply A/b by 1/10^n to improve the display stability.

Example: measuring the linear velocity of the axis. The diameter of the axis is 150 mm. Due to low rotational speed of the axis, we installed a pulse encoder to generate 2000 pulses per revolution. The unit of the displayed reading should be mm/s. Set the meter type to tachometer, P-Sn = 1. So the A/b value should be:

$$A/b = \pi r / (30p) = 0.003925 \quad (3).$$

See Table 5 is for values of A, b, dot, and the corresponding display values.

Table 5. The Meter Resolution at Different Settings

Multiplier A	Multiplier b	Dot	Reading	Resolution
3925	9999	0	X	1
3925	1000	1	X.X	0.1
3925	10	2	X.XX	0.01
3925	1	3	X.XXX	0.001

6.3 Measuring Frequency

Set the meter to frequency meter, P-Sn = 2. The minimum measurable frequency is 1Hz, and the maximum is 6000Hz. Set parameters A, b, and dot to appropriate values to improve the resolution. See table 6 for details.

For example: measuring the electronic frequency with 0.01Hz resolution. Connect the 5V output from a 120V/5V transformer to terminal 1 (IN) and 3 (COM) on the meter. Then, set the meter to frequency meter, P-Sn=2; A=100, b= 1, dot=2, AH1=60.10 (AL1 can be any value between AH1 and 1.00). So the alarm is set as a high alarm and the Alarm should be on when the measured value higher than 60.10Hz.

Table 6. Measurable Frequency Values at Different Settings

Multiplier A	Multiplier b	Dot	Resolution	Min measurable frequency (Hz)	Max measurable frequency (Hz)
1	1	0	1	1	6000
10	1	1	0.1	1.0	600.0
100	1	2	0.01	1.00	60.00
1000	1	3	0.001	1.000	6.000

6.4 Using Progressive Shift Light to Indicate the Range of the Measured Value

Terminal 4, 5, and 6 can each be connected to a lead on the progressive shift light (provided with the meter), which can indicate the range of the input signal. The ranges are determined by A1, A2, and A3 as described in the alarm parameter settings (Table 3). A wiring diagram for using is shown in Figure 6. In the normal operating mode, when PV ≤ A1, no LED will light up; when A1 < PV ≤ A2, only LED1 will light up; when A2 < PV ≤ A3, only LED2 will light up; when PV > A3, only LED3 will light up. A push button can be wired to terminal 2 and 3 to reset the measurement.

7 Notes

7.1 Displaying "EEEE"

Displaying "EEEE" indicates an error has been caused by one of the following situations:

1) The measuring value exceeds the maximum display range. Reset the meter will solve the problem. This can be done by either press the Up key ("Λ") for 2 seconds or short the terminal pin 2 and 3.

2) Zero denominator. When the parameter *b* was set to 0, the actual reading is divided by zero, which will lead to a calculation error. Set *b* to a non-zero value can eliminate this error.

7.2 Build-in Timer

When the "time" parameter (accessed by code 0089) is set to "on", the build-in timer will run whenever the meter is powered on. In Normal Operating Mode, press Up key ("Λ") to switch the display between the meter reading and the timer. When the timer is being displayed, press Up key ("Λ") for 2 seconds to reset the timer. The timer won't be reset by powering off the meter or short the terminal T2 and T3.

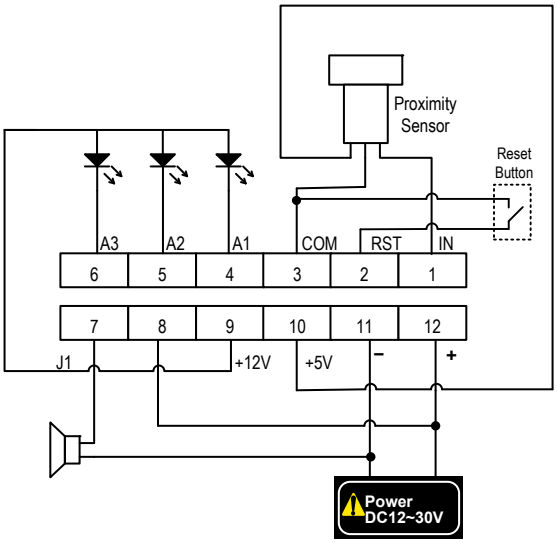

Figure 6. Wiring a proximity sensor and a progressive shift light to ASL-41. One of the LED light will lit when the signal falls into the corresponding range set by A1, A2, and A3.

Auber Instruments
5755 North Point Parkway, Suite 99
Alpharetta, GA 30022
www.auberins.com
Email: info@auberins.com Tel: 770-569-8420