Instruction Manual

SYL-2813A Dual-Input Automotive Multimeter

Version 1.7 (Oct, 2021)

A. Specifications

Table 1. Specifications of SYL-2813 Automotive Multimeter.

Power Supply	DC 12 -30 V (Isolated)
Power Consumption	< 2 Watt
Relay Contact Rating	3 A at 220 VAC
Input Type	**Thermocouple:** K, E, S, R, J, T, B, WRe3/25. **Resistance/RTD:** Pt100, Cu50, (375R)* **Voltage:** 75 mV, 30 mV, 0 - 5V, 1 - 5V, 10V **Amperage:** (0 - 10 mA, 0 - 20 mA, 4 - 20 mA)*
Input Channels	Channel 1, Channel 2
Display Range	-1999 ~ 9999
Accuracy	± 0.2% of full input range or ± 1 unit
LED Display	0.48" LED
Outside Dimension	48 x 48 x 75 mm (1/16 DIN)
Mounting Cutout	45 x 45 mm
Working Condition	-20 ~ 50˚C, 85% RH

*Note: Input types that are in parenthesis are only available to channel 1, these input types are not available to channel 2

B. Front Panel

Figure 1. Front panel of SYL-2813.

① Alarm1 and relay J1 indicator (red LED)
② Alarm2 and relay J2 indicator (red LED)
③ Maximum value indicator of Channel1 (red LED)
④ Maximum value indicator of Channel2 (red LED)
⑤ SET key
⑥ SHIFT key
⑦ DOWN key
⑧ UP key
⑨ Display1 window (top display)
⑩ Display2 window (bottom display)

1. AL1 (or AL2) on indicates alarm is on and J1 (or J2) relay is pulled in (closed).
2. PK1 (or PK2) is on when display windows shows the maximum value MA1 of Channel 1 (or the MA2 of Channel 2) and the time MAt1 (or MAt2) when the peak value was caught.

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 the Parameter Setting Mode, press this key to select the digit to be changed. In the Normal Operating Mode, press this key to toggle the displayed variables between Process Values (PV1 and PV2), Maximum Value of Channel 1 (MA1 and MAt1), and Maximum Value of Channel 2 (MA2 and MAt2). See the diagram below. Please note that time is expressed in seconds when it is less than 9999 seconds. Time longer than 9999 seconds will be displayed as Hours. Minutes (hh.mm).
5. DOWN key "V". In the Parameter Setting Mode, press it to scroll the parameter list in a reversed order or decrease the parameter value. In the Peak Value Checking Mode, press it for 2 seconds to reset the peak values stored in the memory. In the Normal Operating Mode, press this key to toggle the display the current readout and value difference if the feature is enabled.
6. UP key "Λ". In the Parameter Setting Mode, press it to scroll the parameter list or to increase the parameter value. In the Normal Operating Mode, press this key to toggle the display brightness between bright and dim. Each time the key is pressed the display brightness will be changed.
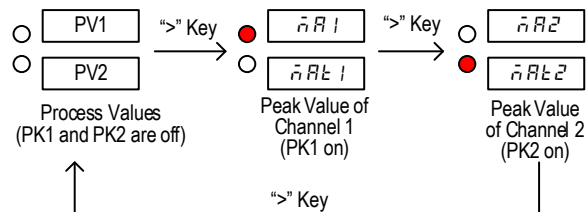

Figure 2. Diagram of how to check Peak Values.
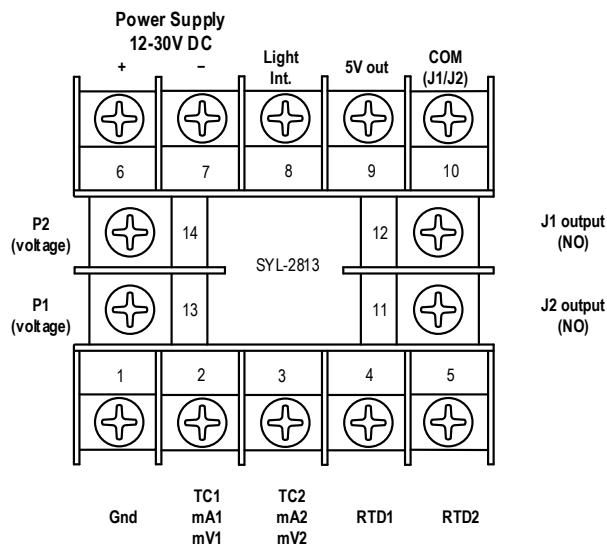
C. Terminal Assignments

Figure 3. Terminal Assignments of SYL-2813.

C.1 Description of Wiring Terminals (T1 ~ T14)

T1: the circuit ground pole for input signals.

T2: for TC, mA, and mV signals in Channel 1 (use withT1).

T3: for TC, mA, and mV signals in Channel 2 (use withT1)

T4: for RTD signal in Channel 1 (use withT1 and T2).

T5: for RTD signal in Channel 2 (use withT1 and T3).

T6: for the positive side of power supply (12 - 30V DC)

T7: for the negative side of power supply (12 - 30V DC)

T8: for +12V DC illumination signal from headlight (use with T7).

T9: a 5V DC power for pressure sensor (use with T13/T14 and T1).

T10: the common pole for J1 and J2 relay.

T11: output for J2 (normally open) relay (use with T10).

T12: output for J1 (normally open) relay (use with T10).

T13: for pressure sensor in Channel 1 (use with T9 and T1).

T14: for pressure sensor in Channel 2 (use with T9 and T1).

Please see Table 2 for a summary for terminal assignment.

Table 2. Summary of Terminal Assignments.

Terminal	Description	Channel	Use With
T1	Circuit Ground (all input sensors)	1 & 2	
T2	TC1, mA1, mV1	1	T1
T3	TC2, mA2, mV2	2	T1
T4	RTD1	1	T1 & T2
T5	RTD2	2	T1 & T3
T6	DC Power Supply, Positive		T7
T7	DC Power Supply, Negative		T6
T8	Headlight signal +12V DC		T7
T9	5V DC output for pressure sensor	1 & 2	
T10	Common pole for relays	1 & 2	
T11	Output for J2 relay		T10
T12	Output for J1 relay		T10
T13	Pressure sensor 1 (voltage signal)	1	T9 & T1
T14	Pressure sensor 2 (voltage signal)	2	T9 & T1

C.2 General Wiring Rules

1. T6 and T7 are power input for the controller, 12-30V DC.

2. T1-T5, T13, and T14 are for different types of input signals. T1 is the circuit ground for all input signals.

3. Wiring of Thermocouples (TC). For Channel 1, connect the positive side of the TC to T2, the negative side to T1. For Channel 2, connect the positive side of the TC to T3, the negative side to T1. (See Figure 4(a).)

4. Wiring of Resistance Temperature Detectors (RTD). In Channel 1, for a three wire RTD, connect the two red wires to T1 and T2, connect white wire to T4; for a two wire RTD, connect the red wire to T2, and connect the white wire to T4, and short T1 and T2. In Channel 2, for a three wire RTD, connect the two red wires to T1 and T3, connect white wire to T5; for a two wire RTD, connect the red wire to T3, and connect the white wire to T5, and short T3 and T1. (See Figure 4(b).)

5. Wiring of Pressure Sensors. In Channel 1, connect the power source wire of the sensor to T9, the signal wire of the sensor to T13, and the ground wire of the sensor to T1. In Channel 2, connect the power source wire of the sensor to T9, the signal wire of the sensor to T14, and the ground wire of the sensor to T1. (See Figure 4(c).)

6. Wiring of mV and mA signals. Wiring for these signals are similar to thermocouple sensors.

7. T8 is for display brightness control. When connecting the illumination signal (+12 VDC) to it, the brightness with synchronized with headlight. If not connected, the brightness can still be controlled by UP key "Λ". Use T8 and T7.

8. Wiring for relay output. J1 and J2 are two normally open relays. T10 is a common pole for both relays. Use T12 and T10 for J1 relay. Use T11 and T10 for J2 relay. (See Figure 4(d).)
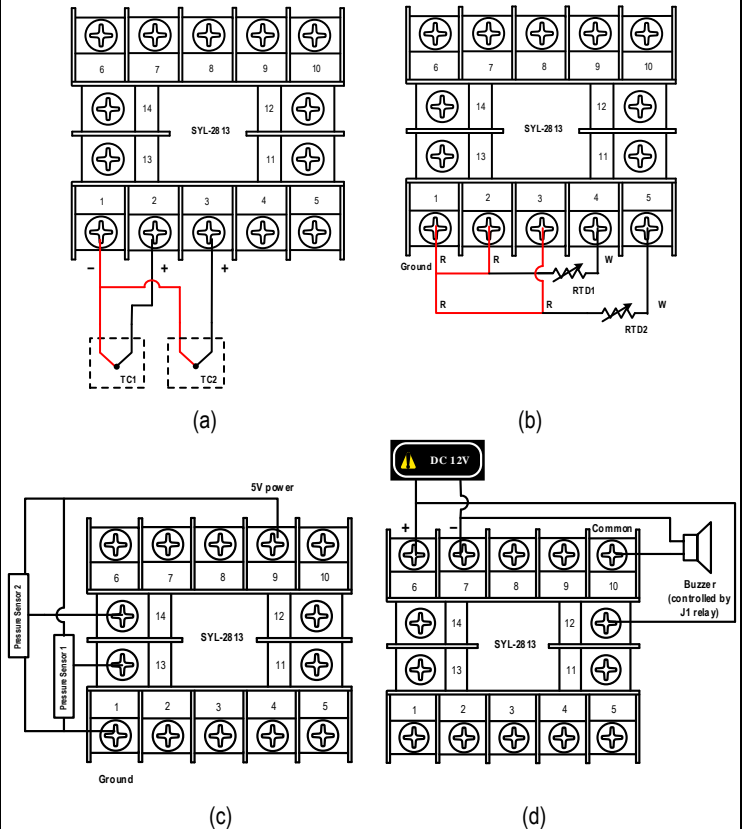

Figure 4. Wiring diagram for (a) thermocouples, (b) RTDs, (c) pressure sensors, and (d) relays.

D. Parameter Settings

D.1 Basic Parameters (Press SET key then enter 0089 to enter setting mode)

D.1.a) Basic Parameters

The gauge SYL-2813 has two input channels that can read signals from two different sensors simultaneously. Each channel can have its own input sensor type, specified scale range, and input offset. See Table 3 for a list of basic parameters, description, range, and initial values. A list of valid types of input sensor is given in Table 4. Please note that all 19 input types are available for Channel 1, but the last three input types in Table 3, i.e., 0 - 10 mA, 0 - 20 mA, and 4 - 20 mA, are not available for Channel 2.

Table 3. Basic Parameters.

Symbol	Name	Description	Channel	Range	Initial	Note
Int1	Int1	Input type of Channel 1	1	See Table 3	P100	1
dot1	dot1	Decimal Point Position 1		0000 ~ 0.000	0	2
PuL1	PuL1	Scale Low 1		-1999 ~ 9999	1000	3
PuH1	PuH1	Scale High 1		-1999 ~ 9999	2000	

PSb1	PSb1	Input Offset 1		-1000 ~ 1000	0	4
Int2	Int2	Input type of Channel 2		See Table 3	Cu50	1
dot2	dot2	Decimal Point Position 2		0000 ~ 0.000	0	2
PuL2	PuL2	Scale Low 2	2	-1999 ~ 9999	3000	3
PuH2	PuH2	Scale High 2		-1999 ~ 9999	4000	
PSb2	PSb2	Input Offset 2		-1000 ~ 1000	0	4
C-F	C-F	Temperature Unit		C, F	C	
Filt	Filt	Filter Coefficient	1 & 2	0 ~ 3	0	5
End	End	Exit				

Note 1. All 19 input types are available to Channel 1. The 375R, 10 mA, 20 mA, and 4 - 20 mA input types are not available to Channel 2.

Note 2. Dot parameter does not work for temperature input sensor (thermocouple, RTD). Thermocouple will be displayed as integer (XXXX). RTD will be displayed with 1 decimal place (XXX.X).

Note 3. Only valid for input types that are neither TC nor RTD.

Note 4. Display Value = gauge reading + **PSb**. Only valid for TC and RTD signals. To enter negative value, please use shift key to shift to first left digit, then use UP and DOWN key to scroll to the negative sign.

Note 5. Digital Filtering Coefficient: 0, no filter; 1, weak; 2, medium; 3, strong.

Table 4. Input type options.

Symbol	Input Type	Gauge Range	Resolution	Accuracy	Impedance
t	TC, Type T	-200 ~ 400 °C	1 °C (°F)	0.3 %	100 K
r	TC, Type R	-50 ~ 1600°C	1°C (°F)	0.3 %	100 K
J	TC, Type J	-200 ~ 1200°C	1°C (°F)	0.3 %	100 K
H r E	TC, WRe3/25	0 ~ 2300°C	1°C (°F)	0.2 %	100 K
b	TC, Type B	260 ~ 1800°C	1°C (°F)	0.2 %	100 K
S	TC, Type S	-50 ~ 1600°C	1°C (°F)	0.3 %	100 K
H	TC, Type K	-200 ~ 1300°C	1°C (°F)	0.2 %	100 K
E	TC, Type E	-200 ~ 850°C	1°C (°F)	0.2 %	100 K
P 100	RTD, Pt100	-199.9 ~ 600.0°C	0.1°C (°F)	0.2 %	(0.2 mA)
Cu50	RTD, Cu50	-50.0 ~ 150.0°C	0.1°C (°F)	0.5 %	(0.2 mA)
375r	375 Ω, Pressure*			0.2 %	(0.2 mA)
75mu	75 mV			0.1 %	100 K
30mu	30 mV	the display value		0.1 %	100 K
0-5u	0 - 5 V	can be set to any		0.1 %	100 K
1-5u	1 - 5 V	range within	16 Bit A/D	0.1 %	100 K
10u	0 - 10 V	(-1999 ~ 9999)		0.1 %	100 K
0-10	0 - 10 mA*			0.3 %	150 K
0-20	0 - 20 mA*			0.2 %	150 K
4-20	4 - 20 mA*			0.2 %	150 K

(TC: thermocouple. RTD: resistance temperature detector.)
*Note: These sensor types are not available to channel 2.

D.1.b) The Procedure of Setting Basic Parameters (see Figure 5).
To set or view Basic Parameters, press SET key once, the upper window will display "pass" and the lower window will display "0000". Change the number to

"0089" in the lower window and press SET again to enter the Parameter Setting Mode. Two parameters from the parameter list will be displayed. The upper window will flash the first parameter, the lower window will steadily display the next parameter on the list (see table 3). Use UP or DOWN key to scroll to the desired parameter (flashing in the upper window) and press SET to view the value. For numerical values, use SHIFT key to go to any digit that needs to be changed and use UP or DOWN key to change the value. For letter values, use UP or DOWN key to select from available values. Then press SET to save and exit to the parameter list. To exit this mode, use UP or DOWN key to scroll to "End" (flashing in the upper display window) and press SET. See Figure 4 for a schematic diagram of how to change Basic Parameters.
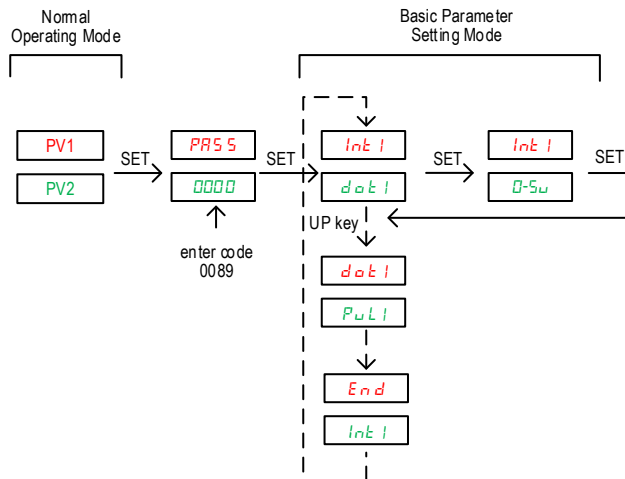

Figure 5. Schematic diagram of how to set Basic Parameters.

D.2 Alarm Parameters (Press SET Key and enter 0001 to enter setting mode)
D.2.a) Alarm Parameters and Alarm Relays
Relay J1 and J2 are normally open (NO) relays associated with alarm settings of Channel 1 and Channel 2 respectively. Each relay has two alarm parameters **AH** and **AL**. The parameter **AH** (**AH1** for Channel 1, or **AH2** for Channel 2) is the relay pull-in temperature, and the parameter AL (**AL1** for Channel 1, or **AL2** for Channel 2) is the relay drop-off temperature. The range for each alarm parameter is shown in Table 5. If **AH > AL**, relay acts as a high temperature alarm relay; if **AH < AL**, relay acts as a low temperature alarm relay; if **AH = AL**, the relay/alarm is disabled. Please see Note 6, Figure 7, and Figure 8 for details.

Table 5. Alarm Parameters.

Symbol	Name	Description	Range	Initial	Note
AH1	AH1	J1 on	-1999 ~ +9999	800	6
AL1	AL1	J1 off	-1999 ~ +9999	900	
AH2	AH2	J2 on	-1999 ~ +9999	800	
AL2	AL2	J2 off	-1999 ~ +9999	900	

Note 6. Relay Action Setting.
For either J1 or J2 relay:
1). When **AH = AL**, relay is disabled.
2). When **AH > AL**, relay is set as high limit alarm (see Figure 6).
3). When **AH < AL**, relay is set as low limit alarm (see Figure 7).
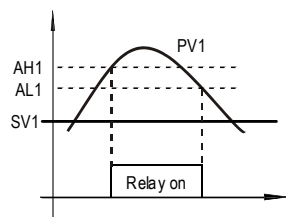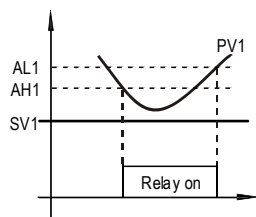
Figure 6. Absolute high alarm on J1.   Figure 7. Absolute low alarm on J1.

D.2.b) How to change parameters under code 0001.
The procedure for setting Alarm Parameters is similar to Basic Parameters showed in Figure 4 except the access code is 0001.

D.3 System Parameters (Press SET then enter 0036 to enter)
Parameters related to peak value recording, display brightness, and input calculation function are grouped under access code 0036.

D.3.a) Parameter Description
Table 6. List of System Parameters.

Symbol	Name	Description	Range	Initial	Note
ⁿA1	MA1	Peak Value 1	on/off	on	
ⁿAt1	MAt1	Timestamp of MA1	on/off	off	7
ⁿA2	MA2	Peak Value 2	on/off	on	
ⁿAt2	MAt2	Timestamp of MA2	on/off	off	7
Clr	Clr	Peak Value Clear	on/off	off	8
bt-L	bt-L	Brightness level -- Low	1 - 2	1	9
bt-H	bt-H	Brightness level -- High	3 - 4	4	9
Fun1	fun1	Function 1: Calculate Input Difference	on/off	off	10
End	End	Exit			

Note 7. When **MA1** (or **MA2**) is set to "off", setting for **MAt1** (or **MAt2**) will be ignored.

Note 8. When **Clr** is set to "off" (default), the controller will keep all the peak values even the power is lost. When **Clr** is set to "on", current peak value will be reset when you reboot this gauge.

Note 9. There are totally 4 brightness levels of the LED display, from 1 to 4, the higher the number, the brighter the display. The brightness of the LED display can be switched between Low (dimmed) and High. The parameter "**bt-L**" defines the brightness level of the dimmed display, while the parameter "**bt-H**" defines the brightness level of the bright display. Supply a 12 VDC signal at terminal 8 or press the UP key ("∧") on the key pad will switch the display level between bright and dimmed display. Please note, you need to switch the brightness level once (press the UP key) to activate the new brightness level settings.

Note 10. This parameter defines whether to enable Function 1, which calculates the arithmetic difference between the readings of two input channels (i.e., Channel 1 - Channel 2). By default, this parameter is set to "off". When "**Fun1**" is set to "on", user can view the calculation result in the lower window by pressing the DOWN arrow key. Press the DOWN key again will switch the lower display back to the probe reading. Please see section **D.3.g** in this manual for details.

D.3.b) How to Change the Parameters Under Code 0036.
The procedure of setting Peak Value Parameters is similar to the Basic Parameters showed in Figure 4 except the access code is 0036.

D.3.c) Check the Peak Value
To check the Peak Value during operation mode, use the SHIFT key ">". Press ">" once, the PK1 indicator will be on, **MA1** and **MAt1** will be displayed in the upper and lower window respectively. Press ">" key again, the PK2 indicator will be on, **MA2** and **MAt2** will be displayed in the upper and lower window respectively; press ">" again to exit this mode and return to the Normal Operating Mode.

D.3.d) Reset the Peak Value
Current Peak Values will be automatically reset when this gauge is powered off. To reset them manually, change display to show **MA1**, **MAt1**, **MA2**, and **MAt2**. Then, press and hold DOWN key "V" for 3 seconds. The display will show "----", indicating the memory (for all four peak parameters) is cleared. The gauge will start to catch the new peak after 2 seconds.

D.3.e) Timer of Peak Values
If MAt1 (or MAt2) is set to "on" a timestamp will be saved when peak value MA1 (or MA2) is recorded. The timer starts counting time after the gauge is powered on. The timestamp will be displayed in seconds if it is less than 9999 seconds; if the timestamp is longer than 9999 seconds, it will be displayed as Hours.Minutes (HH.MM).

D.3.f) Change the Brightness of the Display
The **bt-L** value decides the brightness level of the dim display, available levels are 1 and 2. The **bt-H** value decides the brightness level of the bright display, available values are 3 and 4. There are totally 4 brightness levels of the LED display, from 1 to 4, the higher the number, the brighter the display. Supply a 12 Vdc signal at terminal 8 or press the UP key ("∧") on the key pad will switch the display level between bright and dimmed display.

Note: The gauge needs about 1 - 2 seconds to powering up. Supplying a +12 VDC signal to terminal 8 during the powering up period won't switch the display to dim level; on the contrary, remove the 12 VDC signal from terminal 8 will dim the display.

D.3.g) Show Input Difference
This feature calculates the arithmetic difference between the displayed readings of two input channels, and shows the difference on the channel 2 window:

Input Difference = Channel 1 Reading - Channel 2 Reading.

By default, this feature is turned off (**Fun1** = off). When set **Fun1** = on, this function is enabled. User can check the calculated result in the lower window by pressing the DOWN arrow key. Press the DOWN key again will switch the lower display back to the probe reading. For instance, if Channel 1 is connected to a RTD probe and it shows 200°F, and Channel 2 is connected to another RTD probe that reads 80°F. When press the DOWN arrow key, the lower window will show 120.

Please note that the gauge will calculates the arithmetic difference between Channel 1 and Channel 2 readings despite that these two readings can have

different units. For example, if Channel 1 is reading an EGT probe showing 1000°F, while the Channel 2 is reading a pressure sender showing 50 PSI, when you press the DOWN key, the lower window will show 950.

E. Application Examples
E.1 Measuring Exhaust Gas Temperature (EGT) and Boost Pressure.
The SYL-2813 gauge has two input channels and it can read two different types of signal simultaneously. The wiring diagram of connecting an EGT sensor and a MAP sensor to SYL-2813 is shown in Figure 8. The steps for setting up the gauge for this application is also given in this section.

E.1.a) Wire the EGT sensor (K type thermocouple in this example) and the MAP sensor (AUBER-303) as shown the Figure 7, where the EGT sensor is connected to channel 1 and MAP sensor is connected to channel 2.
E.1.b) Press SET, change the code to 0089 to enter the Basic Parameter Setting mode. Set **Int1** to "k" and **Int2** to "0-5v".
E.1.c) To display the pressure in Bar with 0.01 bar resolution, set the decimal point **dot2** = 2 (this step needs to be done before set **PuL2** and **PuH2**). Set the **PuL2** = -0.38 and **PuH2** = 03.38. (Please see the installation guide for AUBER-303 from the product page on our website).
E.1.d) To display the pressure in PSI with 0.1 PSI resolution, set the decimal point **dot2** = 1. Set **PuL2** = -05.4 and **PuH2** = 048.9.
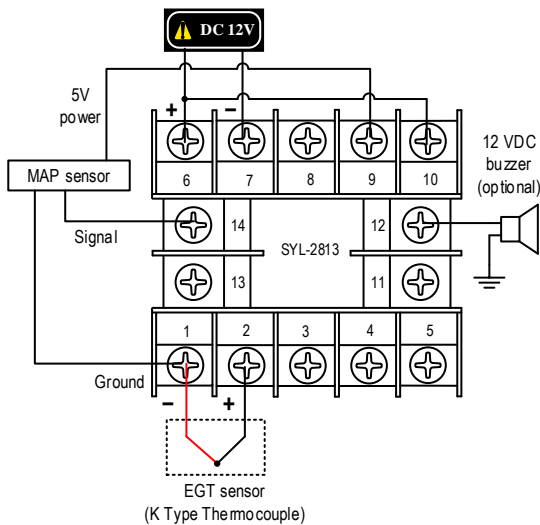

Figure 8. SYL-2813 wiring example of EGT sensor in Channel 1 and MAP sensor in Channel 2.

E.2 Measuring Exhaust Gas Temperature (EGT) and Oil Temperature.
To measure temperatures with one thermocouple sensor and one RTD sensor, you can wire the sensors to SYL-2813 gauge as the diagram in Figure 9. In this diagram, the thermocouple is connected to the Channel 1, and the RTD sensor is connected to the Channel 2. You will need to change the input types and other parameters for Channel 1 and 2 accordingly.

E.3 Read Temperature Difference Between Two Probes.
In this example, a type K thermocouple is wired to channel 1, and a PT100 probe is wired to channel 2 (see Figure 10 for wiring). To set up the gauge to show the temperature difference in the lower window, please use access code 0036, and then set parameter **Fun1** = on. In normal operation mode, the top display will show reading from probe #1, and the lower display will show reading from probe #2. To check the difference, press the DOWN "V" key

shortly, and the lower display will show the difference. Press the DOWN key again, lower display will be switched back to reading from probe #2.
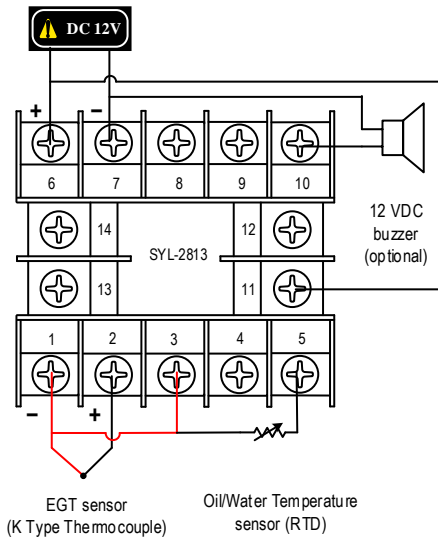

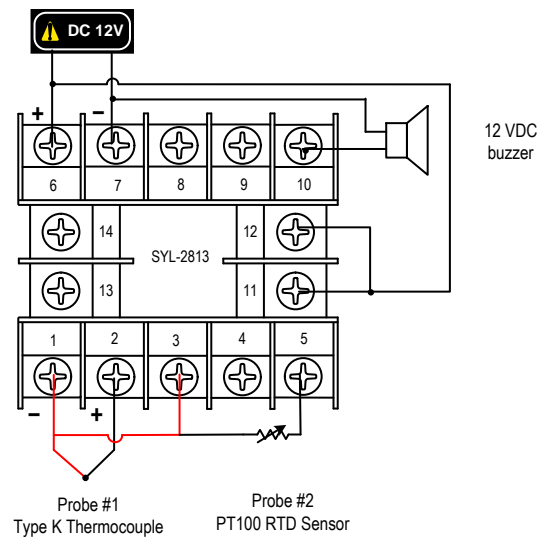Figure 9. SYL-2813 wiring example of an EGT sensor in Channel 1 and an Oil/Water Temperature Sensor in Channel 2.

Figure 10. Wiring diagram of connecting two temperature probes to SYL-2813A gauge and show the temperature difference between two probes.

(End)

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