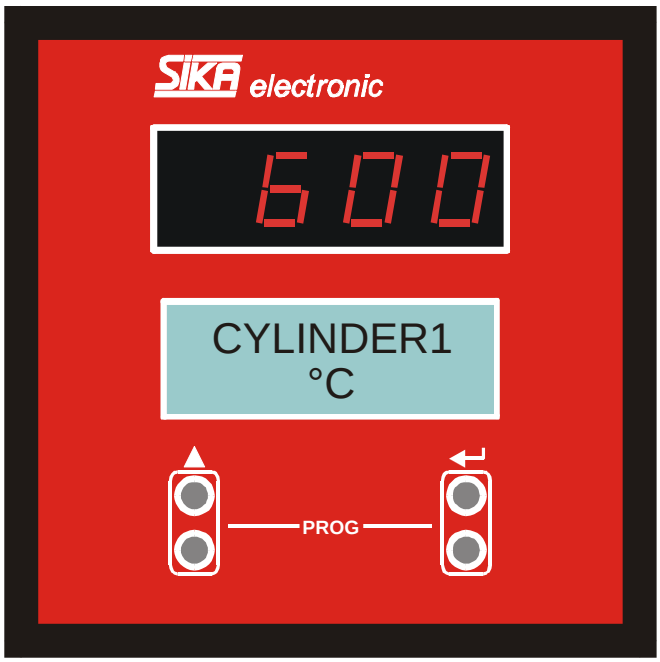
Temperature-Measurement Unit with Manual Test Point Switch

Series TS 31000

Commissioning and Adjustment Manual



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1 About this Manual

This operating manual is for the benefit of skilled and semi-skilled workers.

Read the relevant notes carefully before every move and keep the pre-set sequence.

Read the section "Safety Instructions" with special attention. Remember well the signs (pictograms) and their importance.

The manual is divided in eight sections:

1. General
2. Safety Instructions
3. Description of TS 31000
4. Storage and Set-up
5. Commissioning and Configuration of TS 31000
6. Care and Maintenance
7. Troubleshooting
8. Technical Data

In the case of problems or questions, please contact your local supplier or SIKA directly:

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2 Safety Instructions

The TS 31000 is technically up to date. This applies to measurement accuracy, function principle, and save operation of the instrument. To ensure a safe operation of the instrument, a competent and safety-observing personnel is required.

Related instructions can be found in this section. Warnings which relate to individual function sequences or actions are found at the related chapters of this operating manual. Warnings are marked by special signs.

Attention: Material damage!
This sign draws attention to an action which can cause instruments damage.

Note: This sign draws attention to important remarks.

3 Description of TS 31000

3.1 Assemblies and operating elements

1) LCD matrix display
2) 4-digit LED display
3) light reflex button, Selection key
4) light reflex button, Enter key

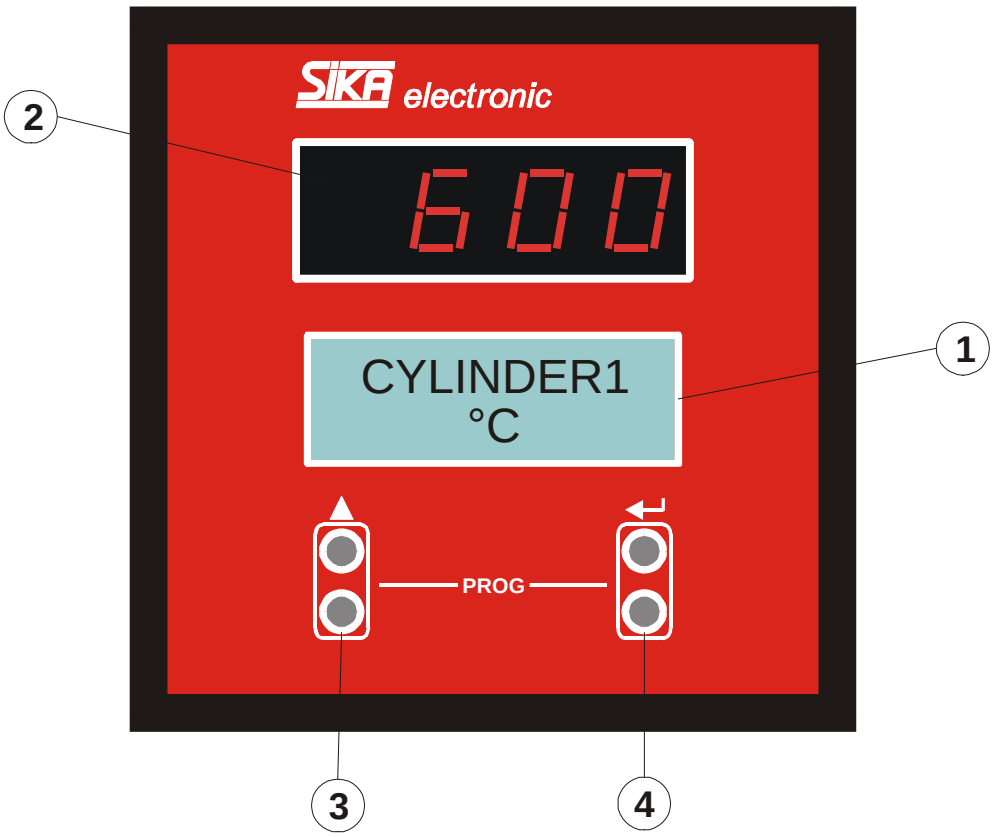

Figure 1: Front side of TS 31000

3.2 Design and Function of TS 31000

The instruments of the TS 31000 type are 32 channel temperature measurement units for thermo couples with a manual test point switch. The selected channel is displayed in plain text on a LCD matrix display ①. The related temperature is shown at the 4 digit LED display ②.

Attention:
Since the reference junctions are only be measured every 60 seconds or at change-over of the blocks, the first valid measuring value has to be displayed after max. 60 seconds.

Programming of the instrument is carried out via the keys ③ and ④. The keys are designed as light reflex buttons. Using these buttons, the point to be measured is selected and the instrument is configured and adjusted to match the required measurement job.

2 Plug-in strip connectors with locking are located at the rear side of the instrument, serving as connectors for thermo couples and cold junctions. A power supply is connected through the 3 pole screwed clamp connection.

The instrument is equipped with a microprocessor. It takes over the entire control and linearizes the characters of the temperature sensors and the cold junction sensors.
A build-in Watchdog-Timer supervises continuously the microprocessor system and switches it into a defined initial condition if an error occurs.

4 Storage and Set-up

4.1 Storage

TS 31000 must be stored dust-protected and dry. The ambient temperature for storage must be between -10 °C and +80 °C.

4.2 Set-up

The instrument is installed in a casing for switchboard front mounting. The front dimensions are 96x96 mm. The cut-out section in the switchboard must be 91x91 mm. The instrument is inserted from the front into the switchboard and is fixed from the rear side by the delivered clamping device.

4.3 Connection

4.3.1 Power supply

The required power supply of TS 31000 is 24 VDC (18...32 VDC) which can be connected to the 3 pole clamp connection at the rear side of the unit. Observe the correct polarity.

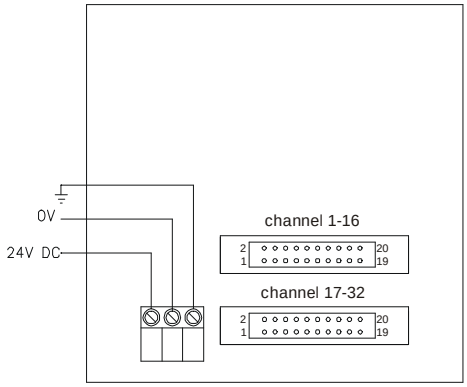

Figure 2: Rear side of TS 31000

4.3.2 Sensor inputs

TS 31000 has 32 thermo couple inputs and two PT100 cold junction inputs. The PT100 inputs are 3 lead inputs.

The connections are distributed to two 20 pole strip connectors (DIN 41651) and Pin 17 is the common negative connector for all thermo couples.

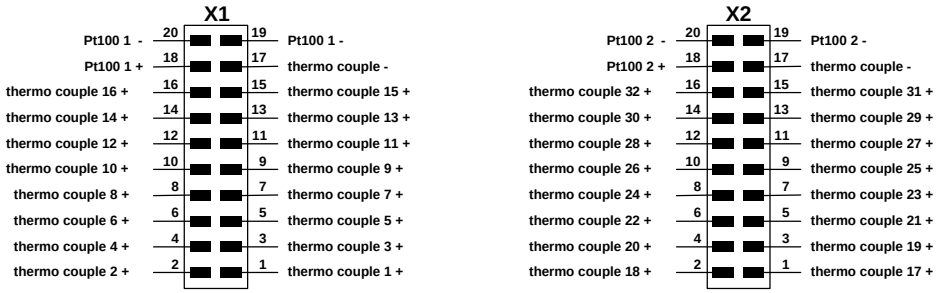

Figure 3: Connector assignment of sensor inputs

Note: If connection and/or calibration leads can be affected by outer influences like electro-magnetic fields, electrical switching processes by thyristor controls etc., the leads should be screened and the screening should be connected to earth. The thermo couples used must have a jacket which is electrically insulated from the element.

5 Commissioning and Configuration of TS 31000

5.1 Commissioning

After the power supply is connected, the instrument displays name and version number. Then the measurement process starts by switching on channel 1. The LCD display shows the name of the first measurement channel in the first line in plain text, the second line shows the unit. The corresponding LED display shows the related measurement value. With the up ▲ and the down ¿ key, the display can be switched through the channels.

Attention:
Since the reference junctions are only be measured every 60 seconds or at change-over of the blocks, the first valid measuring value has to be displayed after max. 60 seconds.

5.2 Configuration of TS 31000

To set up the TS 31000 to perform a requested measurement function, it must be programmed via a configuration menu.
To call up the configuration menus proceed in the following way:

- Press simultaneously key ▲ and key ¿ for about 2 seconds. The display switches to: „CONFIG-MENU“ and the second line displays „0000“. A cursor appears on the 0 at the very left.
- By pressing the ▲ key, set the digit at the cursor position to the same value as with the stored access code.
  Then confirm the digit with the ¿ key. The cursor moves forward one position.
- Set digit by digit in the same manner. After entry of the last digit the instrument is in the configuration menu, provided that the entered number is equal to the stored number. If the entered number is wrong, the TS 31000 switches back to measuring operation.

Note: No customer specific access code is stored by maker. In this case switch into the configuration menu by confirming numerically the default number „0000“ with the ↵ key.

Note: If you do not press a key in the configuration menu within a period of 30 seconds, the instrument will switch back to the last menu item „QUIT CONFIG – NO“ and after further 30 seconds back to measuring operation without any key stroke.

Note: Press simultaneously the ▲ und ↵ - key to quit the configuration menu or go back to the first menu item (SET LANGUAGE) at any place in the menu.
If you confirm with YES, the instrument will return to measurement operation of channel 1.
If you confirm with NO, the instrument will return to the beginning of the configuration menu.

5.2.1 Language selection

To select the language for all displayed messages, proceed as follows:

- Switch to the configuration menu. The following message appears: „SET LANGUAGE – NO“.
- Switch with the ▲ key to „YES“ and confirm with the ¿ key.
- The following messages appears for text messages in German: „DEU/GER/ALL – JA“.
- If you want to change the language, switch with the ▲-key to „NO“ and confirm with the ¿-key. Now the message „ENGLISCH/ANGLAIS – NEIN“ appears for text messages in English and after another click with the ¿-key „FRAN/FREN – NEIN“ for text messages in French and „SPAN/ESPAN – NEIN“ for the Spanish language.
- Switch with the ▲ key to „YES“ and confirm with the ¿ key.
- The next menu item appears: „SET UNIT – NO“.

5.2.2 Select physical measurement unit

To select the measurement unit, proceed as follows:

- Switch to the configuration menu.
- Press the ¿-key until the message „SET DIMENSION – NO“ appears.
- Switch with the ▲ key to „YES“ and confirm with the ¿ key.
- The message appears „TEMPERATURE °C – YES“ for the measurement unit Celsius degree.
- If you want to change the measurement unit, switch with the ▲-key to „NO“ and confirm with the ¿-key. Now „TEMPERATURE °F – NO“ is displayed for the measurement unit Fahrenheit degree and after a repeated click on the ¿-Taste „TEMPERATURE K – NO“ for the measurement unit Kelvin.
- Switch with the ▲ key to „YES“ and confirm with the ¿ key.
- Now the next menu item „SET MOTOR – NO“ is displayed.

5.2.3 **Select motor type** (application)

To select the type of motor, proceed as follows:

- Switch to the configuration menu.
- Press the ¿-key until the message „SET MOTOR – NEIN“ appears.
- Switch with the▲-key to „YES" and confirm with the ¿-key.
- The message appears „Motor Nr.: 00 – JA“ for motor type 00.
- If you want to change the motor type, switch with the ▲-key to „NO“ and confirm with the ¿-key. Now the other motor types 01 to 15 are displayed.
- If you have selected “Motor Nr.:00” the input request “Max.Input” displayed. With the ▲-key you select the number of input. Confirm with the ¿-key. Max. inputs: 32.
- The measuring points of motor type 01-09 are fixed.

Note: A list of the motor types and the according text messages can be found in the delivered appendix.

- If you found the correct motor type, switch with the ▲-key to „YES" and confirm with the ¿-Taste.
- The next menu item appears: „SET SENSORTYPE – NO“.

5.2.4 **Select sensor type**

To select the sensor type (to DIN EN 60584) proceed as follows:

- Switch to the configuration menu.
- Press the ¿-key until the message „SET SENSORTYP – NO“ appears.
- Switch with the ▲-key to „YES" and confirm with the ¿-key.
- The message appears „Sensor: TypK – YES“ for a thermo couple of the K (NiCr-Ni) type.

- If you want to change the sensor type, switch with the ▲-key to „NO“ and confirm with the ¿-key. Now the other sensor types are displayed:

Type E = NiCr-CuNi
Type J = Fe-CuNi
Type T = Cu-CuNi
Type S = Pt10Rh-Pt
Type B = Pt30Rh-Pt6Rh
Type R = Pt13Rh-Pt

- As soon as you have found the correct sensor type, switch with the ▲-key to „YES" and confirm with the ¿-key.
- The next menu item appears „SET ACCESS-CODE – NO“.

5.2.5 Programming the access code

To program a customer-specific access code, proceed as follows:

- Switch to the configuration menu.
- Press the ¿-key until the message „SET ACCESS-CODE – NO“ appears.
- Switch with the▲-key to „YES" and confirm with the ¿-key.
- Set each digit of the new access code with the ▲ key and confirm with the ¿ key.
- To confirm the entry, you must enter the access code a second time. Set again each digit of the new access code with the ▲ key and confirm with the ¿ key.
- The message appears „CODE CHANGE“.

Note: Keep the new access code in mind. From now on the configuration menu can only be called-up by entering this code. Unauthorized persons can no longer change the set parameters.

Note: If the code was wrongly entered, the message „CODE ERROR“ appears.

- Then the message „QUIT CONFIG – NO“ appears.
- If you want to quit the configuration menu, switch with the ▲-key to „YES“ and confirm the message with the ¿-key. Otherwise, the instruments goes back to the menu item „SET LANGUAGE“.
- After quitting the configuration menu, the instrument goes back to measurement operation channel 1.

6 Care, Maintenance and Disposal

6.1 Care and maintenance

Attention: Keep TS 31000 clean. This is especially important for the reading surface to ensure both, a good legibility of the LC-display and a proper operation of the light reflection buttons.

No special maintenance is required for TS 31000.

6.2 Disposal

SIKA will take care of proper disposal.
Return the TS 31000 freight prepaid.

7 Troubleshooting

Attention:
The following table contains remedy actions.

Malfunction	Cause	Remedy
Instead of temperature values, the instrument displays „----„	• Connection between thermo couple and instrument interrupted.	• Check thermo couple and connections
Instrument displays: „REFJUNC. OVERFLOW“	• Value of cold junction is out of permissible range.	• Check cold junction and connections
TS 31000 does not work properly.	• Outer influences, e.g. magnetic fields. • Wrong supply voltage • Faulty installation • Faulty programming.	• Screen the instrument from magnetic fields • Check actual voltage • Check installation • Check programming
Display of silly characters or measurement values.		• Switch off and on the instrument

Note: If the instrument does not work properly after checking of the above mentioned points, contact your supplier or SIKA. Possibly TS 31000 must be checked in the factory.

8 Technical Data

Voltage supply

nominal 24 VDC (18...32 VDC) protected against polarity mix-up, galvanically insulated

Power consumption

2 Watts

Inputs

Thermo couple K, E, J, T, S, B or R. A thermo couple linearization was firmly set in the factory.

Measurement range and accuracy

-90 to	1300 °C	thermo couple type K	±0,15% of r.r. ±1 digit
-90 to	750 °C	thermo couple type E	±0,15% of r.r. ±1 digit
-90 to	1000 °C	thermo couple type J	±0,15% of r.r. ±1 digit
-90 to	350 °C	thermo couples type T	±0,50% of r.r. ±1 digit
100 to	1650 °C	thermo couples type S	±0,15% of r.r. ±1 digit
400 to	1700 °C	thermo couples type B	±0,25% of r.r. ±1 digit
100 to	1650 °C	thermo couples type R	±0,15% of r.r. ±1 digit

Number of measurement channels

maximum 32 inputs for thermo couples
all inputs with over/under voltage protection

Resolution

1K

Measurement rate

120 measurements per minute

Cold junction

twice Pt100, 3 lead technique, measurement range -10 to +100 °C

Display of measurement values

2-line alphanumerical LCD display for text comments
16 digits/line 5,5 mm digit height

4-digit LED display, 15 mm digit height

Selection of measurement channel

via two light reflex buttons ▲ and ¿

Connections

two 20-pole strip connectors to DIN 41651 for thermo couples and cold junctions

3-pole screwed clamp connection for power supply

Dimensions

Front size: 96 x 96 mm,
Depth: 75 mm

Protection class

Front: IP54

Storage and service temperature

-10 to +80 °C / 0 to +55 °C

Appendix: TS 31000 TM 32

INPUT	SET ENGINE									
	STANDARD ENGINE NO.: 00	ENGINE NO.: 01	ENGINE NO.: 02	ENGINE NO.: 03	ENGINE NO.: 04	ENGINE NO.: 05	ENGINE NO.: 06	ENGINE NO.: 07	ENGINE NO.: 08	ENGINE NO.: 09
1	CHANNEL 1	CYLINDER 1	CYLINDER 1	CYLINDER 1	CYLINDER 1	CYLINDER 1	CYLINDER 1	CYLINDER 1A	CYLINDER 1A	CYLINDER 1A
2	CHANNEL 2	CYLINDER 2	CYLINDER 2	CYLINDER 2	CYLINDER 2	CYLINDER 2	CYLINDER 2	CYLINDER 2A	CYLINDER 2A	CYLINDER 2A
3	CHANNEL 3	CYLINDER 3	CYLINDER 3	CYLINDER 3	CYLINDER 3	CYLINDER 3	CYLINDER 3	CYLINDER 3A	CYLINDER 3A	CYLINDER 3A
4	CHANNEL 4	CYLINDER 4	CYLINDER 4	CYLINDER 4	CYLINDER 4	CYLINDER 4	CYLINDER 4	CYLINDER 4A	CYLINDER 4A	CYLINDER 4A
5	CHANNEL 5	CYLINDER 5	CYLINDER 5	CYLINDER 5	CYLINDER 5	CYLINDER 5	CYLINDER 5	CYLINDER 5A	CYLINDER 5A	CYLINDER 5A
6	CHANNEL 6	CYLINDER 6	CYLINDER 6	CYLINDER 6	CYLINDER 6	CYLINDER 6	CYLINDER 6	CYLINDER 6A	CYLINDER 6A	CYLINDER 6A
7	CHANNEL 7		CYLINDER 7	CYLINDER 7	CYLINDER 7		CYLINDER 7		CYLINDER 7A	CYLINDER 7A
8	CHANNEL 8			CYLINDER 8	CYLINDER 8		CYLINDER 8		CYLINDER 8A	CYLINDER 8A
9	CHANNEL 9				CYLINDER 9		CYLINDER 9			CYLINDER 9A
10	CHANNEL 10	TURBO INLET	TURBO INLET	TURBO INLET	TURBO INLET	TURBO INLET 1	TURBO INLET 1	TURBO INLET A	TURBO INLET A	TURBO INLET A
11	CHANNEL 11					TURBO INLET 2	TURBO INLET 2			
12	CHANNEL 12						TURBO INLET 3			
13	CHANNEL 13	TURBO OUTLET	TURBO OUTLET	TURBO OUTLET	TURBO OUTLET	TURBO OUTLET	TURBO OUTLET	TURBO OUTLET A	TURBO OUTLET A	TURBO OUTLET A
14	CHANNEL 14	CHARGE AIR	CHARGE AIR	CHARGE AIR	CHARGE AIR	CHARGE AIR	CHARGE AIR	CHARGE AIR A	CHARGE AIR A	CHARGE AIR A
15	CHANNEL 15									
16	CHANNEL 16									
17	CHANNEL 17							CYLINDER 1B	CYLINDER 1B	CYLINDER 1B
18	CHANNEL 18							CYLINDER 2B	CYLINDER 2B	CYLINDER 2B
19	CHANNEL 19							CYLINDER 3B	CYLINDER 3B	CYLINDER 3B
20	CHANNEL 20							CYLINDER 4B	CYLINDER 4B	CYLINDER 4B
21	CHANNEL 21							CYLINDER 5B	CYLINDER 5B	CYLINDER 5B
22	CHANNEL 22							CYLINDER 6B	CYLINDER 6B	CYLINDER 6B
23	CHANNEL 23								CYLINDER 7B	CYLINDER 7B
24	CHANNEL 24								CYLINDER 8B	CYLINDER 8B
25	CHANNEL 25									CYLINDER 9B
26	CHANNEL 26							TURBO INTLET B	TURBO INTLET B	TURBO INTLET B
27	CHANNEL 27									
28	CHANNEL 28									
29	CHANNEL 29							TURBO OUTLET B	TURBO OUTLET B	TURBO OUTLET B
30	CHANNEL 30							CHARGE AIR B	CHARGE AIR B	CHARGE AIR B
31	CHANNEL 31									
32	CHANNEL 32									

	SET MOTOR					
INPUT	**ENGINE NO: 10** 6SW280	**ENGINE NO: 11** 8SW280	**ENGINE NO: 12** 9SW280	**ENGINE NO: 13** 12SW280	**ENGINE NO: 14** 16SW280	**ENGINE NO: 15** 18SW280
1	CYLINDER A1	CYLINDER A1	CYLINDER A1	CYLINDER A1	CYLINDER A1	CYLINDER A1
2	CYLINDER A2	CYLINDER A2	CYLINDER A2	CYLINDER A2	CYLINDER A2	CYLINDER A2
3	CYLINDER A3	CYLINDER A3	CYLINDER A3	CYLINDER A3	CYLINDER A3	CYLINDER A3
4	CYLINDER A4	CYLINDER A4	CYLINDER A4	CYLINDER A4	CYLINDER A4	CYLINDER A4
5	CYLINDER A5	CYLINDER A5	CYLINDER A5	CYLINDER A5	CYLINDER A5	CYLINDER A5
6	CYLINDER A6	CYLINDER A6	CYLINDER A6	CYLINDER A6	CYLINDER A6	CYLINDER A6
7		CYLINDER A7	CYLINDER A7		CYLINDER A7	CYLINDER A7
8		CYLINDER A8	CYLINDER A8		CYLINDER A8	CYLINDER A8
9			CYLINDER A9			CYLINDER A9
10	TURBO INLET A1	TURBO INLET A1	TURBO INLET A1	TURBO INLET A1	TURBO INLET A1	TURBO INLET A1
11	TURBO INLET A2	TURBO INLET A2	TURBO INLET A2	TURBO INLET A2	TURBO INLET A2	TURBO INLET A2
12	TURBO OUTLET A	TURBO OUTLET A	TURBO OUTLET A	TURBO OUTLET A	TURBO OUTLET A	TURBO OUTLET A
13						
14						
15						
16						
17				CYLINDER B1	CYLINDER B1	CYLINDER B1
18				CYLINDER B2	CYLINDER B2	CYLINDER B2
19				CYLINDER B3	CYLINDER B3	CYLINDER B3
20				CYLINDER B4	CYLINDER B4	CYLINDER B4
21				CYLINDER B5	CYLINDER B5	CYLINDER B5
22				CYLINDER B6	CYLINDER B6	CYLINDER B6
23					CYLINDER B7	CYLINDER B7
24					CYLINDER B8	CYLINDER B8
25						CYLINDER B9
26				TURBO INLET B1	TURBO INLET B1	TURBO INLET B1
27				TURBO INLET B2	TURBO INLET B2	TURBO INLET B2
28				TURBO OUTLET B	TURBO OUTLET B	TURBO OUTLET B
29						
30						
31						

E	SET ENGINE								
INPUT	**STANDARD** **ENGINE NO.: 00**	**ENGINE NO.: 16 KR-3**	**ENGINE NO.: 17 KR-3 w/temp. before turbo**	**ENGINE NO.: 18 KR-5**	**ENGINE NO.: 19 KR-5 w/temp. before turbo**	**ENGINE NO.: 20 KR-6**	**ENGINE NO.: 21 KR-6 w/temp. before turbo**	**ENGINE NO.: 22 KR-8**	
33	CHANNEL 1	01EX CYLINDER 1	01EX CYLINDER 1	01EX CYLINDER 1	01EX CYLINDER 1	01EX CYLINDER 1	01EX CYLINDER 1	01EX CYLINDER 1	
34	CHANNEL 2	02EX CYLINDER 2	02EX CYLINDER 2	02EX CYLINDER 2	02EX CYLINDER 2	02EX CYLINDER 2	02EX CYLINDER 2	02EX CYLINDER 2	
35	CHANNEL 3	03EX CYLINDER 3	03EX CYLINDER 3	03EX CYLINDER 3	03EX CYLINDER 3	03EX CYLINDER 3	03EX CYLINDER 3	03EX CYLINDER 3	
36	CHANNEL 4			04EX CYLINDER 4	04EX CYLINDER 4	04EX CYLINDER 4	04EX CYLINDER 4	04EX CYLINDER 4	
37	CHANNEL 5			05EX CYLINDER 5	05EX CYLINDER 5	05EX CYLINDER 5	05EX CYLINDER 5	05EX CYLINDER 5	
38	CHANNEL 6					06EX CYLINDER 6	06EX CYLINDER 6	06EX CYLINDER 6	
39	CHANNEL 7							07EX CYLINDER 7	
40	CHANNEL 8							08EX CYLINDER 8	
41	CHANNEL 9								
42	CHANNEL 10	10EX AFTER TURBO	10EX AFTER TURBO	10EX AFTER TURBO	10EX AFTER TURBO	10EX AFTER TURBO	10EX AFTER TURBO	10EX AFTER TURBO	
43	CHANNEL 11		11EX BEFORE TURB		11EX BEFORE TURB		11EX BEFORE TURB		
44	CHANNEL 12				12EX BEFORE TURB		12EX BEFORE TURB		
45	CHANNEL 13				13EX BEFORE TURB				
46	CHANNEL 14								
47	CHANNEL 15								
48	CHANNEL 16								
49	CHANNEL 17								
50	CHANNEL 18								
51	CHANNEL 19								
52	CHANNEL 20								
53	CHANNEL 21								
54	CHANNEL 22								
55	CHANNEL 23								
56	CHANNEL 24								
57	CHANNEL 25								
58	CHANNEL 26								
59	CHANNEL 27								
60	CHANNEL 28								
61	CHANNEL 29								
62	CHANNEL 30								
63	CHANNEL 31								
64	CHANNEL 32								

E	SET MOTOR							
INPUT	ENGINE NO.: 23 KR-8 w/temp. before turbo	ENGINE NO.: 24 KR-9	ENGINE NO: 25 KR-9 w/temp. before turbo	ENGINE NO.: 26 KV-12	ENGINE NO.: 27 KV-16	ENGINE NO: 28 KV-18	ENGINE NO: 29	ENGINE NO: 30
1	01EX CYLINDER 1	01EX CYLINDER 1	01EX CYLINDER 1	01AEX CYLINDER1A	01AEX CYLINDER1A	01AEX CYLINDER1A		
2	02EX CYLINDER 2	02EX CYLINDER 2	02EX CYLINDER 2	02AEX CYLINDER2A	02AEX CYLINDER2A	02AEX CYLINDER2A		
3	03EX CYLINDER 3	03EX CYLINDER 3	03EX CYLINDER 3	03AEX CYLINDER3A	03AEX CYLINDER3A	03AEX CYLINDER3A		
4	04EX CYLINDER 4	04EX CYLINDER 4	04EX CYLINDER 4	04AEX CYLINDER4A	04AEX CYLINDER4A	04AEX CYLINDER4A		
5	05EX CYLINDER 5	05EX CYLINDER 5	05EX CYLINDER 5	05AEX CYLINDER5A	05AEX CYLINDER5A	05AEX CYLINDER5A		
6	06EX CYLINDER 6	06EX CYLINDER 6	06EX CYLINDER 6	06AEX CYLINDER6A	06AEX CYLINDER6A	06AEX CYLINDER6A		
7	07EX CYLINDER 7	07EX CYLINDER 7	07EX CYLINDER 7		07AEX CYLINDER7A	07AEX CYLINDER7A		
8	08EX CYLINDER 8	08EX CYLINDER 8	08EX CYLINDER 8		08AEX CYLINDER8A	08AEX CYLINDER8A		
9		09EX CYLINDER 9	09EX CYLINDER 9			09AEX CYLINDER9A		
10	10EX AFTER TURBO	10EX AFTER TURBO	10EX AFTER TURBO	10AEX AFT TURBO	10AEX AFT TURBO	10AEX AFT TURBO		
11	11EX BEFORE TURB		11EX BEFORE TURB	11AEX BFR TURBO	11AEX BFR TURBO	11AEX BFR TURBO		
12	12EX BEFORE TURB		12EX BEFORE TURB					
13			13EX BEFORE TURB					
14								
15								
16								
17				01BEX CYLINDER1B	01BEX CYLINDER1B	01BEX CYLINDER1B		
18				02BEX CYLINDER2B	02BEX CYLINDER2B	02BEX CYLINDER2B		
19				03BEX CYLINDER3B	03BEX CYLINDER3B	03BEX CYLINDER3B		
20				04BEX CYLINDER4B	04BEX CYLINDER4B	04BEX CYLINDER4B		
21				05BEX CYLINDER5B	05BEX CYLINDER5B	05BEX CYLINDER5B		
22				06BEX CYLINDER6B	06BEX CYLINDER6B	06BEX CYLINDER6B		
23					07BEX CYLINDER7B	07BEX CYLINDER7B		
24					08BEX CYLINDER8B	08BEX CYLINDER8B		
25						09BEX CYLINDER9B		
26				10BEX AFT TURBO	10BEX AFT TURBO	10BEX AFT TURBO		
27				11BEX BFR TURBO	11BEX BFR TURBO	11BEX BFR TURBO		
28								
29								
30								
31								
32								