KERNEL Sistemi s.r.l. - Via Vignolese , 1138 - 41100 Modena
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36109 Series

KS381, KS391, KS433

USER MANUAL

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1.0 Memory

The PLC has 1024 internal memory locations, each one at 16 bits (1 word) each locations is called DATA . These locations are designed to contain the running program's variables, and they are called from **DATA.00** to **DATA.1024**. These locations are visible and shared from PLC side and also from the operator panel side, so they can be read and write from both two.
Some internal DATA are system words, or rather have fixed meaning, instead others are free and thay can be used, from the application program, for any purpose. The value write into a system DATA is interpreted as a specific parameter; the table 1.0 show the system data memory map.

Note

Typically to do calculations and insert values into the application program, are used the words from DATA.200 onwards .

1.1 16 and 32 bits operations

The operations on data memory are usually at 16 bits, namely they are of the same size of DATAs, any data memory can have a decimal value from 0 to 65535 (2^16) . However is possible need biggest size variables (long at 32 bits): these numerical values are stored into two consecutive DATAs (lowest address = least significant word, highest address = more significant word). The operations which work with long variables are preceded by the prefix 'L', and they take account of this format automatically, so for example:

Instruction list	Ladder	Commentary
LMOV #1234,DATA.100		put 0 value in DATA.100 and the 1234 value in DATA.101
LMOV #65537,DATA_100		put 1 in DATA.100 and 1 into DATA.101

Note

Using 16bit operations and others at 32bits, in the same application program, may generate chaos. It is therefore advisable to standardize the work method; alternatively be very careful to rimember that in case of LONG operations, the data memory indicated on software is always the most significant.

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1.2 Redempive memory and volatile memory

Volatile memory : words from **DATA.00** to **DATA.415** are volatile, except of those otherwise specified in picture 4.0 .

Buffered RAM : Since the E²PROM has a maximum finite number of writings, declared by the manufacturer (more or less 100.000 for any single DATA) to meet the need of frequent and numerous saves, was planned a buffered RAM dedicated memory area. The locations are from **DATA.416** to **DATA.511** and they are automatically copied into buffered RAM every 100msec and reloaded at the PLC switch-on with the last value. The RAM is buffered with a rechargeable battery, with the fully charged battery the autonomy is **1 year**, *if the TSP is turned off for a longer time DATA may be lost*. The bufferd RAM is always enabled and don't needs abilitation.

E²PROM : The locations from **DATA.512** to **DATA.12024** are used for the DATA saving into E²PROM and so they are non-volatile DATA. You can save the datas in E²PROM in two ways: automaticaly by the remote writing, or by software with a command. Remote writing means any external device connected to PLC by serial port with Kernel Sistemi protocol, which modifies the value of this DATA (also the Flash debug use the Kernel Sistemi protocol). Also the editing of a display's variable is considered remote writing. The software writing, instead, needs to use of **DATA.27**, **DATA.28** and **SYS.16** the two DATAs must contain respectively the address of the first DATA to save and the address of the last DATA to save whereas the saving will start setting SYS.20 who then will reset itself. At the switching time, the saved DATA, takes the last stored value.

Note

Before start to write the application program, it's good divide volatile datas and non-volatile datas. Once made this dinstinction, will be necessary think what non-volatile datas should be system paramiters and what should be machine parameters. Generally the working parameters are alla those values necessary to work which must be continuously saved to, for example, continue to work next day (for example the number of machined parts) , the machine parameters instead will be the values given like machine set up , which maybe will modify only a technician, into a page under password.

WARNING!

The EEPROM for their characteristic allow a limitate writes (more or less 100.000 for any single data memory address). Above that limit the EEPROM doesn't work anymore and must be replaced, is therefore recommended not to exceed this limit otherwise it can cause the device malfunction.

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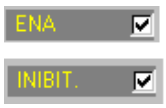
1.3 Memory map

Any DATA in this table is a 16 bits word. Any DATA which isn't speified in this table is to be considered “free” .

Picture 4.0

<table>
<tr><td>DATA.00</td><td>Current page number. This DATA is in reading mode and also in writing mode, so will be read to know what page is show on diplay and it can be write to change the page.</td></tr>
<tr><td>DATA.01</td><td>DATA command. Some bits of this DATA have a special meaning :
<table>
<tr><th>N° bit</th><th>descrizione</th></tr>
<tr><td>0</td><td>Signalling but not alarm displaying. If this bit is enable, the TSP beeps repeated, blink the ALR led and on display will appear a “bell button” which blink. Pushing the “bell button” (if at least one alarm bit is active) you will enter in pages of alarm management.</td></tr>
<tr><td>1</td><td>Immediate alarm displaying. If it is active with also an alarm bit, the alarm page is immediately shown on display.</td></tr>
<tr><td>2</td><td>Display alarm mode. This bit is active when on the TSP screen is shown an alarm page. If is programmed a scroll alarm time into “project option” page, the TSP will do the automatic alarm scroll with the programmed time. If the operator push the “E” button into the alarm page, is resetted the alarm bit into TSP.</td></tr>
<tr><td>3</td><td>It is active in variable's input mode. Input variable mode is enabled when is push the variable on touch screen to insert a new value and appear the numeric keyboard; in this case, the bit number three of DATA.01 is one, and go to zero when the new value is confirmed with the “E” button.</td></tr>
<tr><td>10</td><td>Print current page. Print of the current page if is selected the PRINTER protocol on serial port.</td></tr>
<tr><td>11</td><td>Read/write variables inhibition. Is possile enable or disable from PLC the variables modifing. To do this is necessary select the box ENA into the variable's settings window (which allow the variable modify from touch screen) and the INIBIT. Box (which the variable modify in accordance with this bit state).
 
</td></tr>
</table></td></tr>
</table>

....

DATA.03	Last modified variable address.

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DATA.04

DEDICATED

First alarm word. From alarm 0 to 15. For each bit is associated the corresponding alarm page. **THIS ALARM WORD IS FULLY DEDICATED TO COMUNICATION ERRORS OR SYSTEM ALARMS (don't use this DATA)**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ALR 15	ALR 14	ALR 13	ALR 12	ALR 11	ALR 10	ALR 9	ALR 8	ALR COM 5	ALR COM 4	ALR COM 3	ALR COM 2	ALR COM 1	ALR COM 0	ALR CAN 1	ALR CAN 0

DATA.05

From alarm 16 to alarm 31. **FIRST USABLE ALARM WORD**

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ALR 31	ALR 30	ALR 29	ALR 28	ALR 27	ALR 26	ALR 25	ALR 24	ALR 23	ALR 22	ALR 21	ALR 20	ALR 19	ALR 18	ALR 17	ALR 16

DATA.06	From alarm 32 to alarm 47. Each bit is associated to the respective alarm page.
DATA.07	From alarm 48 to alarm 63. Each bit is associated to the respective alarm page.
DATA.08	From alarm 64 to alarm 79. Each bit is associated to the respective alarm page.
DATA.09	From alarm 80 to alarm 95. Each bit is associated to the respective alarm page.
DATA.10	From alarm 96 to alarm 111. Each bit is associated to the respective alarm page.
DATA.11	From alarm 112 to alarm 127. Each bit is associated to the respective alarm page.
DATA.12	From alarm 128 to alarm 143. Each bit is associated to the respective alarm page.
DATA.13	From alarm 144 to alarm 159. Each bit is associated to the respective alarm page.
DATA.14	From alarm 160 to alarm 175. Each bit is associated to the respective alarm page.
DATA.15	From alarm 176 to alarm 191. Each bit is associated to the respective alarm page.
DATA.16	From alarm 192 to alarm 207. Each bit is associated to the respective alarm page.
DATA.17	From alarm 208 to alarm 223. Each bit is associated to the respective alarm page.
DATA.18	From alarm 224 to alarm 239. Each bit is associated to the respective alarm page.
DATA.19	From alarm 240 to alarm 255. Each bit is associated to the respective alarm page.

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DATA.22	When it's different to zero, the PLC read the specified external variable.	
DATA.23	External variable number's which must be write (look § External Variables)	
DATA.24	Value to write on the external variable (look § External Variables)	
DATA.25	Least significant word in case that the value to write is 32bits value.	
DATA.26	Nodo di errore comunicazione	
DATA.27	Indirizzo del primo dato da salvare in E²PROM / Numero ricetta	
DATA.28	Indirizzo dell'ultimo dato da salvare in E²PROM / Data memory di inizio ricetta (specificare solo il numero del DATA)	
DATA.29	Dimensione ricetta (numero di DATA)	
DATA.30	PLC speed (in µsec)	
DATA.31	Day of the month (calendar clock)	RO
DATA.32	Day of the week (calendar clock)	RO
DATA.33	Month (calendar clock)	RO
DATA.34	Year (calendar clock)	RO
DATA.35	Hour (calendar clock)	RO
DATA.36	Minutes (calendar clock)	RO
DATA.37	Seconds (calendar clock)	RO
DATA.38	Number of days elapsed since the beginning of the year.	RO
DATA.39	Number of minutes elapsed since the beginning of the year.	RO
DATA.40	Week prog	
DATA.41	Week prog	
DATA.42	Week prog	
DATA.43	Week prog	
DATA.44	Week prog	
DATA.45	Week prog	
DATA.46	Week prog	

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DATA.47	Week prog
DATA.48	Week prog
DATA.49	Week prog
DATA.50	Week prog
DATA.51	Week prog
DATA.52	Week prog
DATA.53	Week prog
DATA.54	Week prog
DATA.55	Week prog
DATA.56	Week prog
DATA.57	Week prog
DATA.58	Week prog
DATA.59	Week prog
DATA.60	Week prog
DATA.61	Week prog
DATA.62	Week prog
DATA.63	Week prog
DATA.64	Week prog
DATA.64	Week prog
DATA.65	Week prog
DATA.66	Week prog
DATA.67	Week prog
DATA.68	Week prog
DATA.69	Week prog
DATA.70	Week prog

DATA.71	Week prog
DATA.72	Week prog
DATA.73	Week prog
DATA.74	Week prog
DATA.74	Week prog
DATA.75	Week prog
DATA.76	Week prog
DATA.77	Week prog
DATA.78	Week prog
DATA.79	Week prog
DATA.80	Week prog
DATA.81	Week prog
DATA.82	Week prog
DATA.83	Week prog
DATA.84	Week prog
DATA.85	Week prog
DATA.86	Week prog
DATA.87	Week prog
DATA.88	Week prog

...

DATA.96	Cold junction temperature

...

DATA.100	Analog input channel 0 - *ISTANT VALUE* [bit]
DATA.101	Analog input channel 1 - *ISTANT VALUE* [bit]
DATA.102	Analog input channel 2 - *ISTANT VALUE* [bit]

DATA.103	Analog input channel 3 - *ISTANT VALUE* [bit]	
DATA.104	Analog input channel 0 – *AVERAGED VALUE* [bit]	
DATA.105	Analog input channel 1 - *AVERAGED VALUE* [bit]	
DATA.106	Analog input channel 2 - *AVERAGED VALUE* [bit]	
DATA.107	Analog input channel 3 - *AVERAGED VALUE* [bit]	
DATA.108	Temperatur Analog input channel 0 [degrees]	
DATA.109	Temperature Analog input channel 1 [degrees]	
DATA.110	Temperature Analog input channel 2 [degrees]	
DATA.111	Temperature Analog input channel 3 [degrees]	
DATA.112	Input – PID 0 REGULATOR	
DATA.113	Set Point – PID 0 REGULATOR	
DATA.114	Cycle time (dsec) – PID 0 REGULATOR	
DATA.115	Regulation band – PID 0 REGULATOR	
DATA.116	Integral value – PID 0 REGULATOR	
DATA.117	Derivative value – PID 0 REGULATOR	
DATA.118	Alarm level – PID 0 REGULATOR	
DATA.119	Actuation (regulation PID output from 0 to 255 to DAC) – PID 0 REGULATOR	RO
DATA.120	Input – PID 1 REGULATOR	
DATA.121	Set Point – PID 1 REGULATOR	
DATA.122	Cycle time (dsec) – PID 1 REGULATOR	
DATA.123	Regulation band – PID 1 REGULATOR	
DATA.124	Integral value – PID 1 REGULATOR	
DATA.125	Derivative value – PID 1 REGULATOR	
DATA.126	Alarm level – PID 1 REGULATOR	
DATA.127	Actuation (regulation PID output from 0 to 255 to DAC) – PID 1 REGULATOR	RO

DATA.128	PID Attuation for PWM output channel 0	
DATA.129	PID Attuation for PWM output channel 1	

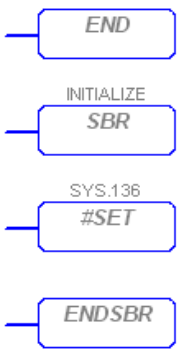
Legend	
commentary	***icon***
E²PROM saved DATA	
Read only DATA	RO

2.0 System flags

The TSP have more or less 180 system flags (SYS). Every system flag is write like : " **SYS.nn** " . The SYS are single bits (0 o 1) and it can be of two types :

- The SYS used by operative system to signal a resource state (for example there are the time SYS, enabled every second, every minute etc ...)
- Otherwise there are SYS which must be enabled by the application program to enable a specific PLC resource (for example the encoder input isn't a fast encoder input if isn't triggered the appropriate SYS, and so on for other resources)

The second case, namely a resource enable with a SYS, is usually done inside the INITIALIZE subroutine; because this subroutine is read always the first PLC cycle, in this way the resourece will be enable from the PLC start for all the program duration.
Example, if you want use the monodirectional encoder 0:

Instruction list	Ladder	Commentary
END SBR INITIALIZE #SET SYS.136 ENDSBR		The unconditional SYS setting runs immediately at the first program cycle, enabling in this way the encoder. Just as they would through a switch, at the application start the program put ON this resource.

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Complete map of all the system flags :

SYS.00	Always false
SYS.01	Always true
SYS.02	Enable only the first program cycle
SYS.03	Flag used by the CMP intruction (compare) : SYS.03 enabled if the two compared operands are equal. OPR1 = OPR2
SYS.04	Flag used by the CMP intruction (compare) : SYS.04 enabled if the first operand is lower than second. OPR1 < OPR2
SYS.05	Flag used by the CMP intruction (compare) : SYS.05 enabled if the first operand is higher than second. OPR1 > OPR2

…

SYS.08	Enabled every 10 msec
SYS.09	Enabled every 100 msec
SYS.10	Enabled every second
SYS.11	Enabled every minute
SYS.12	Enabled every 15 minutes
SYS.13	Enabled every hour
SYS.14	Blinking 0.5 sec ON , 0.5 sec OFF
SYS.15	Beeper enable
SYS.16	EEPROM save forcing (DATA.27 = start, DATA.28 = stop)
SYS.17	Memory bank saving into EEPROM
SYS.18	Memory bank restoration from EEPROM

…

SYS.24	Weekly program N°1 enable
SYS.25	Weekly program N°2 enable
SYS.26	Weekly program N°3 enable
SYS.27	Weekly program N°4 enable

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SYS.28	Weekly program N°5 enable
SYS.29	Weekly program N°6 enable
SYS.30	Weekly program N°7 enable
SYS.31	Weekly program N°8 enable
SYS.32	Weekly program N°9 enable
SYS.33	Weekly program N°10 enable
SYS.34	Weekly program N°11 enable
SYS.35	Weekly program N°12 enable
SYS.36	Weekly program N°13 enable
SYS.37	Weekly program N°14 enable
SYS.38	Weekly program N°15 enable
SYS.39	Weekly program N°16 enable
SYS.40	Enable P.I.D. 0
SYS.41	P.I.D. 0 temperature regulation
SYS.42	Enable attuation DAC - P.I.D. 0
SYS.43	P.I.D. 0 output
SYS.44	Ready (enable inside the regulation band SP +/- Band) P.I.D. 0

…

SYS.48	Enable P.I.D. 1
SYS.49	P.I.D. 1 temperature regulation
SYS.50	Enable attuation DAC - P.I.D. 1
SYS.51	P.I.D. 1 output
SYS.52	Ready (enable inside the regulation band SP +/- Band) P.I.D. 1