

SDM SERIES MODBUS PROTOCOL Made by Sanup Electric Co. Ltd.
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Supplementary
Operating Instructions
For Serial Data Communication

Nov. 16. Ver 3.0

SDM series Process Controller

MODBUS[®] Protocol

SANUP ELECTRIC CO. LTD.
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SDM series with RS485

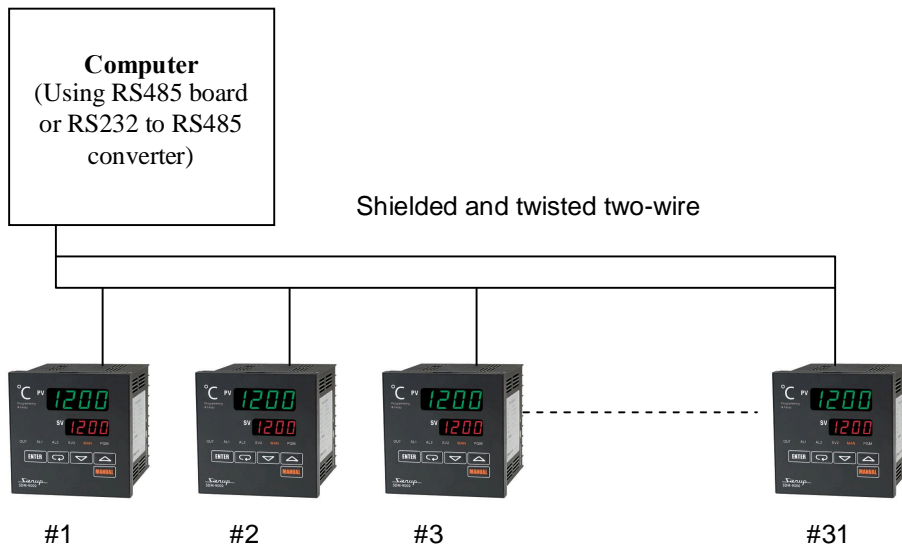
1. Description

The SDM series with RS485 option uses serial communication allowing it to communicate over long distances with a computer or other types of instruments. It uses a two-wire system and does not need additional communication lines.

When used with a computer, the maximum length of communication wire is 1.2km (4600 ft). In addition, to increase communication reliability, the communication line of the system can be connected in a ring shape.

- 1) Communication method: HDX (half duplex) RS485
- 2) Maximum distance: 1.2km (4600ft)
- 3) Maximum number of connections: 31 / port
- 4) Communication data: 1 START, 8 DATA, 1 STOP Bit, NO PARITY
- 5) Speed: Selectable between 2400, 4800, 9600 BPS
- 6) Protocol: **MODBUS[®]** ASCII

2. SDM series Communication number and speed set up



Prior to using the RS485 feature, the address and communication speed need to be set up.

- 1) Apply power to the SDM series and go to parameter group 6 (communication). Refer to the SDM series user manual for instructions on changing parameter groups.
- 2) Set up the address (AddS) and speed (SPEd) of the SDM series communication.

NOTE 1: Set the speed parameter (SPEd) to 2400 for communication speed of 2400 BPS

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Set the speed parameter (SPEd) to 4800 for communication speed of 4800 BPS

Set the speed parameter (SPEd) to 9600 for communication speed of 9600 BPS

NOTE 2: Set the address parameter (AddS) to give the SDM series a communication number. Setting the AddS parameter to 0 disables communication.

NOTE 3: See the SDM user manual for details on how to use the controller.

WARNING: Every SDM controller connected to the communication line must have the same speed and each controller must have a different communication number to operate properly.

3. Connecting Communication Wire

When making the communication connection observe the correct polarity. When the distance between a computer and SDM series is short (i.e. less than 10m or 33 feet) a twisted pair of wires can be used. Shielded wire should be used for longer distances.

For optimum performance the communication line must use matching resistance. To accomplish this there is a jumper on the inside of the controller. This jumper is set to the **M+** position from the factory and should be left in this position if only one controller is being used. If more than one controller is used, only the final controller should have the jumper set to **M+**. All other controllers should have the jumper set to the other position.

Referring to the following figures, connect the matching resistor of the final controller by putting the jumper in **M+** location on the PC board of SDM controller.

Make all other connections as outlined in the SDM series user manual.

WARNING: The last SDM in the communication line must have the jumper set to "M". When SDMs are added or removed, the jumper position should be checked to ensure correct connection.

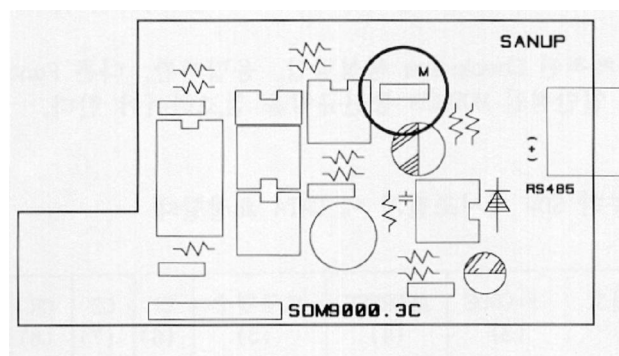


Figure 1. SDM series Jumper Position

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4. Reading internal variable data of the SDM series (MODBUS® Function Code 03)

Function code 03 is used to request variable data from the SDM via a computer or an external instrument. The procedure to receive data is as follows.

NOTE: Refer to general MODBUS® communication rules for detailed Check-Sum method, response time, and definitions of other function codes.

- 1) In the following example the data of the %Integral Time+variable is requested from the SDM series with an AddS number of 01. When requesting data from the SDM series using a computer the request is formatted as follows:

:	Address	F-Code	Data Address	Amount of data requested	C1	C2	CR	LF
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

- (1) Start bit: (:)
- (2) SDM address (AddS) number: (01 . 31)
- (3) MODBUS® function code: (03)
- (4) Four digit address of data: 0003 (See the Tables Starting at 7.1)
- (5) Amount of data requested: 0001 (# of bytes in four digits)
- (6) CHECK-SUM HIGH: (C1)
- (7) CHECK-SUM LOW: (C2)
- (8) Carriage return: (CR)
- (9) Line feed: (LF)

e.g.: The above data would look like this: **010300030001** C1, C2, CR, LF

- 2) The response of the SDM series to the request is formatted as follows:

:	Address number	F-Code	Number of responding bytes	Value of data requested	C1	C2	CR	LF
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

- (1) Start bit: (:)
- (2) SDM address (AddS) number: (01 . 31)
- (3) Repeat of the MODBUS® function Code: (03)
- (4) Number of responding bytes: (0001)
- (5) Value of data requested: 000A (2 bytes in HEX code)
- (6) CHECK-SUM HIGH: (C1)
- (7) CHECK-SUM LOW: (C2)
- (8) Carriage return: (CR)
- (9) Line feed: (LF)

e.g.: The response would look like this: **010302000A** and C1,C2,CR, LF
 The response indicates the integral time is 10 seconds (000A HEX).

5. Changing Data in the SDM series (MODBUS® Function Code 06)

Function code 06 is used to change the data of variables in the SDM via a computer or external instrument. The procedure to change data is as follows.

NOTE: Refer to general MODBUS® communication rules for detailed Check-Sum method, response time, and definitions of other function codes.

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- 1) In the following example the data contained in the SDM series data address number 3 (integral time) will be changed to 15 seconds (HEX 000F).

:	Address	F-Code	Data Address	Amount of data requested	C1	C2	CR	LF
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

- (1) Start bit: (:)
- (2) SDM Address (AddS) Number: (01 . 31)
- (3) MODBUS® Function Code: (06)
- (4) Address of data to be changed: (0003)
- (5) New data: (000F) (HEX for 15)
- (6) CHECK-SUM HIGH: (C1)
- (7) CHECK-SUM LOW: (C2)
- (8) Carriage return: (CR)
- (9) Line feed: (LF)

e.g.: The above data being transmitted to the SDM would look like this :**01060003000F**
 C1, C2, CR, LF and the integral time would be changed to 15 seconds (000F).

- 2) SDM series response after data change

- 1) If the data change was completed properly the SDM will respond by sending back the original request.
- 2) If the data transfer was not completed properly the SDM will respond with the following message.

:	Address	F-Code	Data failure code	C1	C2	CR	LF
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

- (1) Start bit: (:)
- (2) SDM address (AddS) number: (1 . 31)
- (3) MODBUS® function code: (86)
- (4) Data failure code: (02)
- (5) CHECK-SUM HIGH: (C1)
- (6) CHECK-SUM LOW: (C2)
- (7) Carriage return: (CR)
- (8) Line feed: (LF)

e.g.: For example if the integral time change was not completed properly or if the integral time is too low the response from the SDM would look like this: :**018602**
 C1,C2,CR, LF

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6. SDM series Parameter Addresses and Functions

The following tables contain all of the SDM series parameters. The table lists their address numbers and functions.

The tables are set up as follows:

- 1) Parameter address: The addresses are in hexadecimal code.
- 2) Symbol: The parameter symbol as shown on the SDM display.
- 3) Parameter adjustment range: The minimum and maximum allowable limits for the given parameter.
- 4) Parameter function: Description of the variable.
- 5) All parameters are in integer form only. All numbers after the decimal point will be removed.
- 6) Parameters are classified into groups by functions.

NOTE: Refer to the SDM series manual for details on parameter functions and adjustment ranges.

6-1. Tuning Parameter Group

This is the group of parameters used during operation of the controller. In this group it is possible to adjust the Tuning parameters. (Desired Value selection, Output intervals, PID, Dead zone, Alarm set up, Auto-tuning start)

Address is 4 digit, but for convenience, it is 2 digit. (0003 to 3, 0013 to 13)

- R/W: Enable read and write
R/FW: Enable read but disable write on program control
R: Read only
N: Enable read but not use

Parameter Address (DEC)	Symbol	Parameter Adjustment Range	Parameter Function	Parameter Type
0	----	Selected value	Shows current selected value. It is Read only.	R
1	----	Output Manual Control (-5.0 ~ 105.0%)	Output control applied only when it is done manually.	R/W
2	PAtn	No. of Pattern	Selected pattern no. 0: pattern 1. 1: pattern 2. 2: connection patterns	R/FW
3	PASS	Pass no.	Set only controller	N
4	COntF	Configuration Group	Set only controller	N
5	P	Proportional Band (0.5 ~ 999.8%)	Set up the proportional band. The unit is %	R/W
6	I	Integral Time	Set up the integral time. The unit is	R/W

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		(0~9998 sec.)	seconds. Note) When 0 is selected, operates in proportional mode.	
7	d	Derivative Time	Set up derivative time. The unit is seconds. Note) When 0 is selected, the derivative function is disabled.	R/W
8	HyS	Dead Zone	Set up the dead zone when ON/OFF control mode is selected	R/W
9	AL-1	Alarm 1	Set up Alarm 1 Note) if Alarm 1 is set up as LBA, pattern completed, or Contact cooled-output, alarm related to the measured value will not be performed	R/W
10	AL-2	Alarm 2	Set up the Alarm 2	R/W
11	CP	Output Intervals (1~60 sec.)	Set up Relay and SSR output control interval. The unit is seconds.	R/W
12	At	A.T. Start/Cancel	Start or cancel Auto-Tuning 2 : Start Auto-Tuning 0 : Cancel Auto-Tuning	R/W
13	SV-H	Set Value High Limit	0~9000	R/W
14	SV-L	Set Value Low Limit	-900~8000	R/W

NOTE: the range of Alarm set up is limited by the input type.

6-2. Input/Output Variable Group

Parameter Address (HEX)	Symbol	Parameter Adjustment Range	Parameter Function	Parameter Type
15	InPt	Set up the input	Set up the input sensor. Refer to table on for sensor types and values for address.	R/W
16	OUPt	Set up the Output	Set up the output. 0 : Relay (contact) output control 1 : SSR output control 2 : Current output control note) Refer to SDM operators manual.	R/W
17	Unit	Input unit	Select °F/°C 0 : Celsius 1 : Fahrenheit note) this applies to temperature input only	R/W
18	dP	Decimal point	Set up the decimal point position. Used for analog input only.	R/W
19	SC-H	Scale-High 0 ~ 9000	Set up the high value. Used for analog input only.	R/W
20	SC-L	Scale-Low -900 ~ 8000	Set up the low value. Used for analog input only.	R/W
21	mr	Manual Reset	Set up the manual reset. Unit : %	R/W

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		(0.0 ~ 100.0 %)		
22	FILt	Input Filter (0~60 sec.)	Set up the time of the input filter. Unit: seconds. This applies when the display drifts due to noise Note) the value affects the derivative	R/W
23	InS	Sensor Correction	Input Sensor Correction Note) Temperature input, the unit is : 0.1° Analog input, the unit is same as the input	R/W

Table 1. Input Sensor Type Parameter InPt Values (Address 000C)

Value of InPt address 000C	Symbol	Input Sensor Type	Measuring Range	
			Celsius	Fahrenheit
0	K-tC	K-TYPE	-70 ~ 1370°C	-94 ~ 2498°F
1	J-tC	J-TYPE	-70 ~ 950°C	-94 ~ 1742°F
2	E-tC	E-TYPE	-70 ~ 750°C	-94 ~ 1382°F
3	n-tC	N-TYPE	-100 ~ 1300°C	-148 ~ 2372°F
4	C-tC	C-TYPE	0 ~ 2300°C	32 ~ 4172°F
5	t-tC	T-TYPE	-130 ~ 400°C	-202 ~ 752°F
6	K1tC	K-TYPE	-100.0~400.0°C	-148~752°F
7	r-tC	R-TYPE	0 ~ 1760°C	32 ~ 3200°F
8	S-tC	S-TYPE	0 ~ 1760°C	32 ~ 3200°F
9	b-tC	B-TYPE	0 ~ 1800°C	32 ~ 3272°F
10	JPt	JIS Pt100 RTD	-200 ~ 600°C	-328 ~ 1112°F
11	dPt	DIN Pt100 RTD	-200 ~ 600°C	-328 ~ 1112°F
12	JPt1	JIS Pt100 RTD	-200.0 ~ 600.0°C	-328 ~ 1112°F
13		DIN Pt100 RTD	-200.0 ~ 600.0°C	-328 ~ 1112°F
14	1-5	1-5VDC	Scaling	
15	0-5	0-5VDC	Scaling	

6-3. Alarm and Transmission output Group

This parameter group allows the set up of the alarms, dead zone, LBA time, transmission output, as well as other functions.

Parameter Address (HEX)	Symbol	Parameter Adjustment Range	Parameter Function	Parameter Type
24	ALS.1	Alarm 1	Set up Alarm 1 0: Alarm not activated 1: High end 2: Standby High Alarm 3: Low end 4: Standby Low Alarm 5: Deviation High Alarm	R/W

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			6: Deviation Low Alarm 7: Deviation Alarm 8: LBA Alarm 9: End the set up program control output 10: Control condition	
25	HyS.1	Alarm 1 Dead zone	Set up the alarm 1 dead zone	R/W
26	ALS.2	Alarm 2	Same as Alarm 1 above except LBA and Output.	R/W
27	HyS.2	Alarm 2 Dead zone	Set up the alarm 2 dead zone.	R/W
28	LbA	LBA time (0~9998 sec.)	When Alarm 1 is set to LBA, set up LBA time. Unit: seconds Note 1) set up at 0, Alarm not- activated Note 2) When perform the Auto-tuning, it will set up automatically twice of integral time.	R/W
29	rEt	Transmission	Set up the transmission 0: Send Measured value 1: Send the set up values 2: Send Control output	R/W
30	t-H	Transmission High end	Set up the high end of transmission output	R/W
31	t-L	Transmission Low end	Set up the low end of transmission output	R/W
32	d-tm	Heating Output (0~30 min.)	Set up the heating output. Unit : minutes Note 1) 0 input, heating output function be not-activated. Note 2) This function applies only to the current (4-20mA) control output	R/W

6-4. Input Parameter Group

This is the group of parameters for measurement and output control.

Parameter Address (HEX)	Symbol	Parameter Adjustment Range	Parameter Function	Parameter Type
33	----	Measurement	PV	R
34	----	Output Control	MV	R

6-5. Control Group

This parameter group allows the set up of the second set point, contact input. Control output for sensor failures, output control, as well as other functions.

Parameter Address (HEX)	Symbol	Parameter Adjustment Range	Parameter Function	Parameter Type
35	----	#1	Set up the desired value for #1	R/W

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36	SP-2	#2	Set up the desired value for #2, selected contact input	R/W
37	dl	Set up the contact input	Set up the contact input functions 0: select the set value for #2 1: Change Auto/Manual 2: Hold the set values during program control 3: RUN/STOP of program control 4: Control output OFF Note: When set up as A/M or Hold, front keys for (A/M) are disabled.	R/FW
38	At-S	A.T	Auto-tuning 0: Halt Auto-tuning 1: Start Auto-tuning	R/W
39	FUZY	Fuzzy	Control Overshoot 0: Halt Fuzzy Logic 1: Start Fuzzy Logic	R/W
40	b.OUT	Burn ~Out output (0~100%)	Set up the output when Burn-out (sensor failure) occurs Unit: %	R/W
41	CACT	Control	Set up the control 0: Forward ON-OFF 1: Forward PID 2: Reverse PID 3: Reverse ON-OFF 4: Heating - Cooling	R/W
42	mV-H	Control Output High End (0.0 ~ 105.0%)	Set up the control output high end Unit: % Note1) if the value is less than 99.9%, Halt Auto-tuning Note2) if the set up value is less than 99.9%, no activation on LBA Note 3) In case of contact output, over 100% will be recognized as 100%	R/W
43	mV-L	Control Output Low End (-5.0 ~ 100.0%)	Set up the control output low end Unit: % Note 1) if the set up value is less than 0.1%, halt Auto-tuning Note 2) In case of contact output, less than 0% will be recognized as 0%	R/W
44	CG.AP	Heating/Cooling Dead Zone (1.0 ~ 50.0%)	Set up the dead zone of Heating/Cooling output. Unit: % In this zone, both heating and cooling will be non-activated	R/W
45	CG.An	Cooling Gain (0.1 ~ 10.0 X)	Set up the Cooling output Gain Note: Used to adjust the cooling speed	R/W
46	CtyP	Set up the cooling output	Set up the cooling control output 0: Relay output (applies to Alarm 2 output) 1: 4-20mA output (applies to transmission output)	R/W
47	C-Cy	Cooling output	If the cooling output is relay (Alarm 2	R/W

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		intervals (1~60sec.)	output), set up the intervals of output Unit: second	
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6-6. Control Mode Parameter Group

Parameter Address (HEX)	Symbol	Parameter Adjustment Range	Parameter Function	Parameter Type
48	----	MODE	0: Manual 1: Auto 2: Auto-tuning (read only) Note: Auto-tuning start/cancel can be done only in parameter 0009	R/W
49	----	Set up-program MODE	0: Halt the set up-program 1: set up-programming 2: Hold the set up values during the program 3: Hold the set up values after the program 4: Hold the set up values after the program and control output are off.	R

NOTE: It is impossible to change the mode of manual/auto in the following cases.

- (1) While in Auto-tuning
- (2) While operating in set up-program mode
- (3) When using contact input
- (4) Other controls are heating/cooling, heating, on-off (refer to the SDM operators manual)

6-7. Set up Program Control Parameters

NOTE: The following variables are all read only.

6-7-1. Set for Pattern No. 1

Parameter Address (HEX)	Symbol	Parameter Adjustment Range	Parameter Function	Parameter Type
50	r.S.En	Enable programming	Decide whether programming is enabled. 0: Enabled 1: Fix mode control 2: Fix mode control with standby control output	R/FW

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51	WAI t	Set up Wait	Set up the wait value (note) Set to 0 when the wait is not necessary	R/FW
52	P.Srt	Restart Mode	In case of no power, set up the restart mode. 0 : reset 1 : restart at segment #1	R/FW
53	SG.nO	Number of segment	Set up the number of segment (1 to 10)	R/FW
54	SOR G	Start Value	Set up the start value at segment #1	R/FW
55	Smod	Start Mode	0 : Start from segment #1 with the set up value for SOR 1 : Start from segment #1 with the current measured value	R/FW
56	SV 1	S1 ending value	Ending value of segment #1	R/FW
57	tm 1	S1 time	Segment #1 time Unit: minutes	R/FW
58	SV 2	S2 ending value	Ending value of segment #2	R/FW
59	tm 2	S2 time	Segment #2 time Unit: minutes	R/FW
60	SV 3	S3 ending value	Ending value of segment #3	R/FW
61	tm 3	S3 time	Segment #3 time Unit: minutes	R/FW
62	SV 4	S4 ending value	Ending value of segment #4	R/FW
63	tm 4	S4 time	Segment #4 time Unit: minutes	R/FW
64	SV 5	S5 ending value	Ending value of segment #5	R/FW
65	tm 5	S5 time	Segment #5time Unit: minutes	R/FW
66	SV 6	S6 ending value	Ending value of segment #6	R/FW
67	tm 6	S6 time	Segment #6 time Unit: minutes	R/FW
68	SV 7	S7 ending value	Ending value of segment #7	R/FW
69	tm 7	S7 time	Segment #7 time Unit: minutes	R/FW
70	SV 8	S8 ending value	Ending value of segment #8	R/FW
71	tm 8	S8 time	Segment #8 time Unit: minutes	R/FW
72	SV 9	S9 ending value	Ending value of segment #9	R/FW
73	tm 9	S9 time	Segment #9 time Unit: minutes	R/FW
74	SV 10	S10 ending value	Ending value of segment #10	R/FW
75	tm 10	S10 time	Segment #10 time	R/FW

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76	SV 11	S11 ending value	Ending value of segment #11	R/FW
77	tm 11	S11 time	Segment #11 time	R/FW
78	SV 12	S12 ending value	Ending value of segment #12	R/FW
79	tm 12	S12 time	Segment #12 time	R/FW
80	Endm	End	Select to end the programming 0: Hold the last segment 1: Reset 2: Repeat 1 3: Repeat 2 4: Repeat 3 5: Repeat 4 6: Repeat 5 7: Repeat 6 8: Repeat 7 9: Repeat 8 10: Repeat 9	R/FW

6-7-2. Set for Pattern No. 2

Parameter Address (HEX)	Symbol	Parameter Adjustment Range	Parameter Function	Parameter Type
81	WAIt	Set up Wait	Set up the wait value (note) Set to 0 when the wait is not necessary	R/FW
82	P.Srt	Restart Mode	In case of no power, set up the restart mode. 0: reset 1: restart at segment #1	R/FW
83	SG.no	Number of segment	Set up the number of segment (1 to 10)	R/FW
84	SOrG	Start Value	Set up the start value at segment #1	R/FW
85	Smod	Start Mode	0: Start from segment #1 with the set up value for SOrG 1: Start from segment #1 with the current measured value	R/FW
86	SV 1	S1 ending value	Ending value of segment #1	R/FW
87	tm 1	S1 time	Segment #1 time Unit: minutes	R/FW
88	SV 2	S2 ending value	Ending value of segment #2	R/FW
89	tm 2	S2 time	Segment #2 time Unit: minutes	R/FW
90	SV 3	S3 ending value	Ending value of segment #3	R/FW
91	tm 3	S3 time	Segment #3 time Unit: minutes	R/FW
92	SV 4	S4 ending value	Ending value of segment #4	R/FW

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93	tm 4	S4 time	Segment #4 time Unit: minutes	R/FW
94	SV 5	S5 ending value	Ending value of segment #5	R/FW
95	tm 5	S5 time	Segment #5time Unit: minutes	R/FW
96	SV 6	S6 ending value	Ending value of segment #6	R/FW
97	tm 6	S6 time	Segment #6 time Unit: minutes	R/FW
98	SV 7	S7 ending value	Ending value of segment #7	R/FW
99	tm 7	S7 time	Segment #7 time Unit: minutes	R/FW
100	SV 8	S8 ending value	Ending value of segment #8	R/FW
10	tm 8	S8 time	Segment #8 time Unit: minutes	R/FW
102	SV 9	S9 ending value	Ending value of segment #9	R/FW
103	tm 9	S9 time	Segment #9 time Unit: minutes	R/FW
104	SV 10	S10 ending value	Ending value of segment #10	R/FW
105	tm 10	S10 time	Segment #10 time	R/FW
106	SV 11	S11 ending value	Ending value of segment #11	R/FW
107	tm 11	S11 time	Segment #11 time	R/FW
108	SV 12	S12 ending value	Ending value of segment #12	R/FW
109	tm 12	S12 time	Segment #12 time	R/FW
110	Endm	End	Select to end the programming 0: Hold the last segment 1: Reset 2: Repeat 1 3: Repeat 2 4: Repeat 3 5: Repeat 4 6: Repeat 5 7: Repeat 6 8: Repeat 7 9: Repeat 8 10: Repeat 9	R/FW