



# NOVA Series

## Communication Manual

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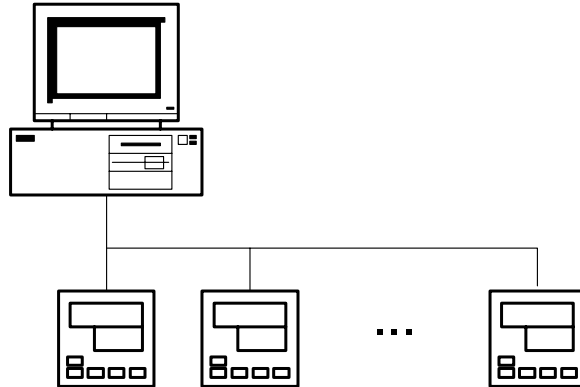
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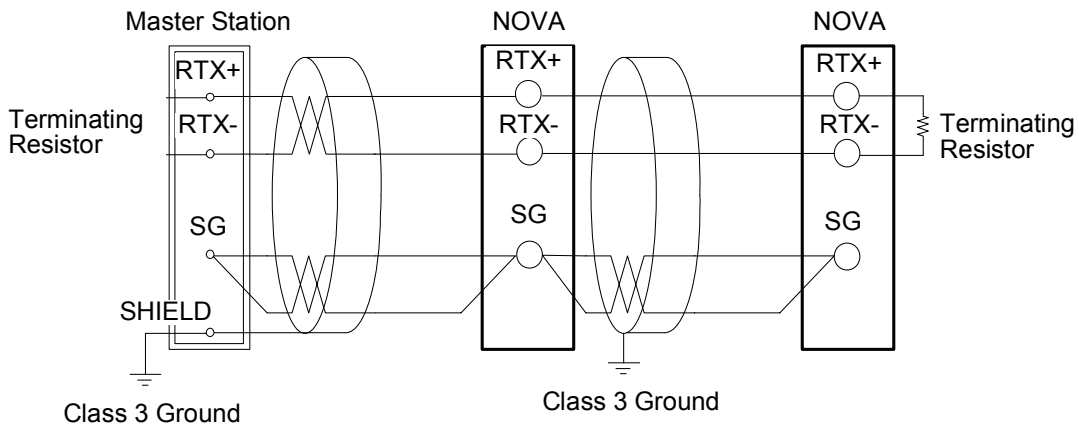
## 1. NOVA Series Communication Overview

NOVA Series communication is processing by Half-Duplex with 2-wire via RS485, and is equipped variable type of protocol for communication between upper-level (or computer), is connected up to 31 units.



## 2. Wiring (RS485)

Wiring between NOVA Series and upper-level system.( or computer)



- Up to 31 units of NOVA could be connected. (MULTIDROP)
- Terminating Resistor (200Ω 1/4W) should be connected on both of Master stations and last slave controller.

### 3. Communication Parameters

There are parameters for setup the communication condition as under.

Parameters	Process	Code	Descriptions	Default
COM.P	Protocol	0	Standard Protocol	X
		1	Standard Protocol + Check Sum	O
		2	MODBUS ASCII	X
		3	MODBUS RTU	X
		4	SYNC-Master	X
		5	SYNC-Slave	X
BAUD	Baud Rates	4	9600bps	O
		3	4800bps	X
		2	2400bps	X
		1	1200bps	X
		0	600bps	X
PTRY	Parity	NONE	No parity	O
		EVEN	Even	X
		ODD	Odd	X
SBIT	Stop Bit	1	1bit	O
		2	2bits	X
DLEN*	Data Length	7	7bits	X
		8	8bits	O
ADDR	Address	1~99	Address	1
RPTM	Response time	0~10	Response time : Processing time + RPTM * 10msec	0

\* Data Length(DLEN) is not for Modbus type.

## 4. Standard Protocol

Nova's standard protocol communication is running with ASCII code and is writing defined D-Register and I-Register. There are 2 kinds of protocol, it is selected by parameter. Standards protocol is '0' and more this standards protocol structure is started with 0x02 (STX:Start Text) and finish with CR(0x0D) LF(0x0A). 'SUM' is consist of standard protocol + Check Sum for error code.

### (A) Standard protocol frame structure

STX	Address	Command	Data	CR	LF
0x02	1~99	See each Command		0x0D	0x0A

### (B) SUM frame structure

STX	Address	Command	Data	Check Sum	CR	LF
0x02	1~99	See each Command		Sum	0x0D	0x0A

Communication with sum check, the ASCII codes of the text between STX and before checksum are converted into hexadecimal values and added on a byte basis. Then the lowermost byte of the added results is turned into ASCII code, and its lower byte is used as the checksum.(Lower 2 bytes)

## 4.1. Communication Command

NOVA communication command is consists of D-Register, general command for Read/Write for I-Register and information of Nova model name and version.

### (A) General Command

Command	Descriptions
RSD	D-Register consecutive Read
RRD	D-Register Random Read
WSD	D-Register consecutive Write
WRD	D-Register Random Write
RSI	I-Register consecutive Read
RRI	I-Register Random Read
WSI	I-Register consecutive Write (Common Area only)
WRI	I-Register Random Write (Common Area only)
STD	D-Register Monitoring Set
CLD	D-Register Monitoring Call
STI	I-Register Monitoring Set
CLI	I-Register Monitoring Call

### (B) Information Command

Command	Descriptions
AMI	Show self information

### (C) Error Response

Nova is responding on error occurrence as under

Bytes	1	2	2	2	2	1	1
Frame	S T X	Address	NG	Error Code	SUM	C  R	L  F

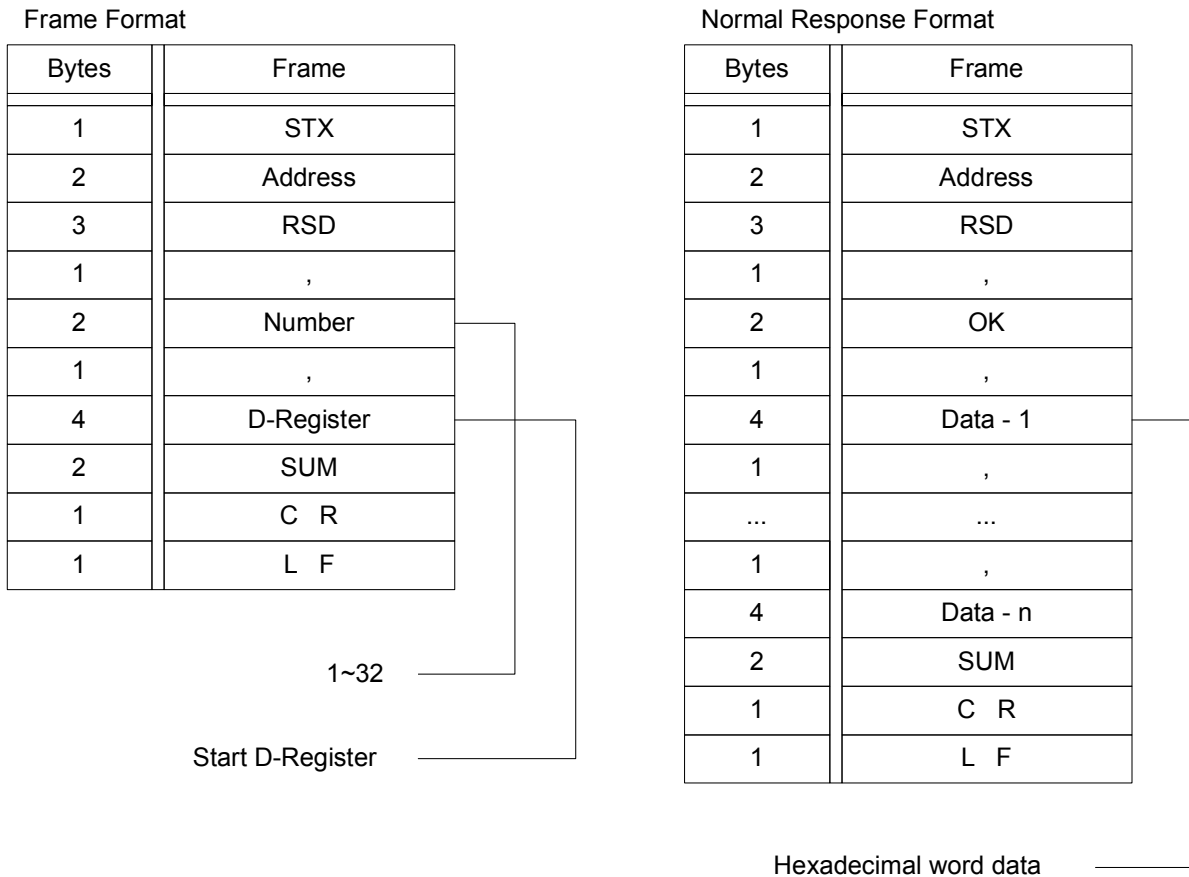
SUM is using only for PROTOCOL is '1' (See 4.4. Error Code)

## 4.2. General Command

### 4.2.1. Read Command

#### (A) RSD Command

RSD is command for reading consecutive D-Register. Set the number of reading and the start D-Register No. on the Frame.



ex) When reading the D-Register from PV(D0001) to SP(D0002)

- Transmission : [stx]01RSD,02,0001[cr][lf]
- Transmission (Include Check Sum) : [stx]01RSD,02,0001C5[cr][lf]

If received data are PV=50.0 and SP=30.0, the result is as under;

- Reception : [stx]01RSD,OK,01F4,012C[cr][lf]
- Reception (Include Check Sum) : [stx]01RSD,OK,01F4,012C19[cr][lf]

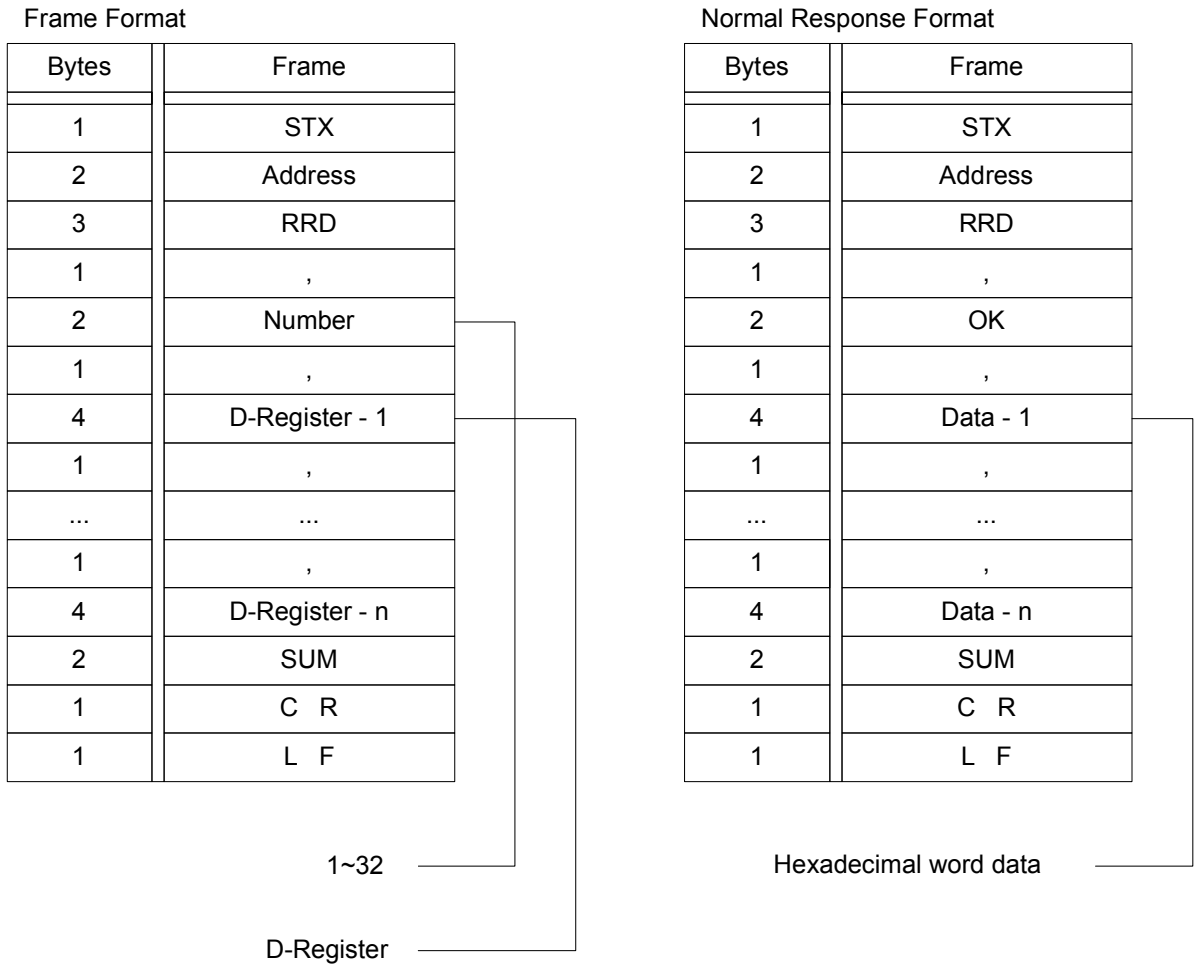
※ The converting process for display received hexadecimal PV value.

- ①. Converting decimal : 01F4 (Hexadecimal) → 500(Decimal)
- ②. Result × 0.1 : 500 \* 0.1 → 50.0



## (B) RRD Command

RRD is command for reading random D-Register. Set the number of reading and each D-Register number.



ex) When reading the D-Register of PV(D0001) and SP(D0002)

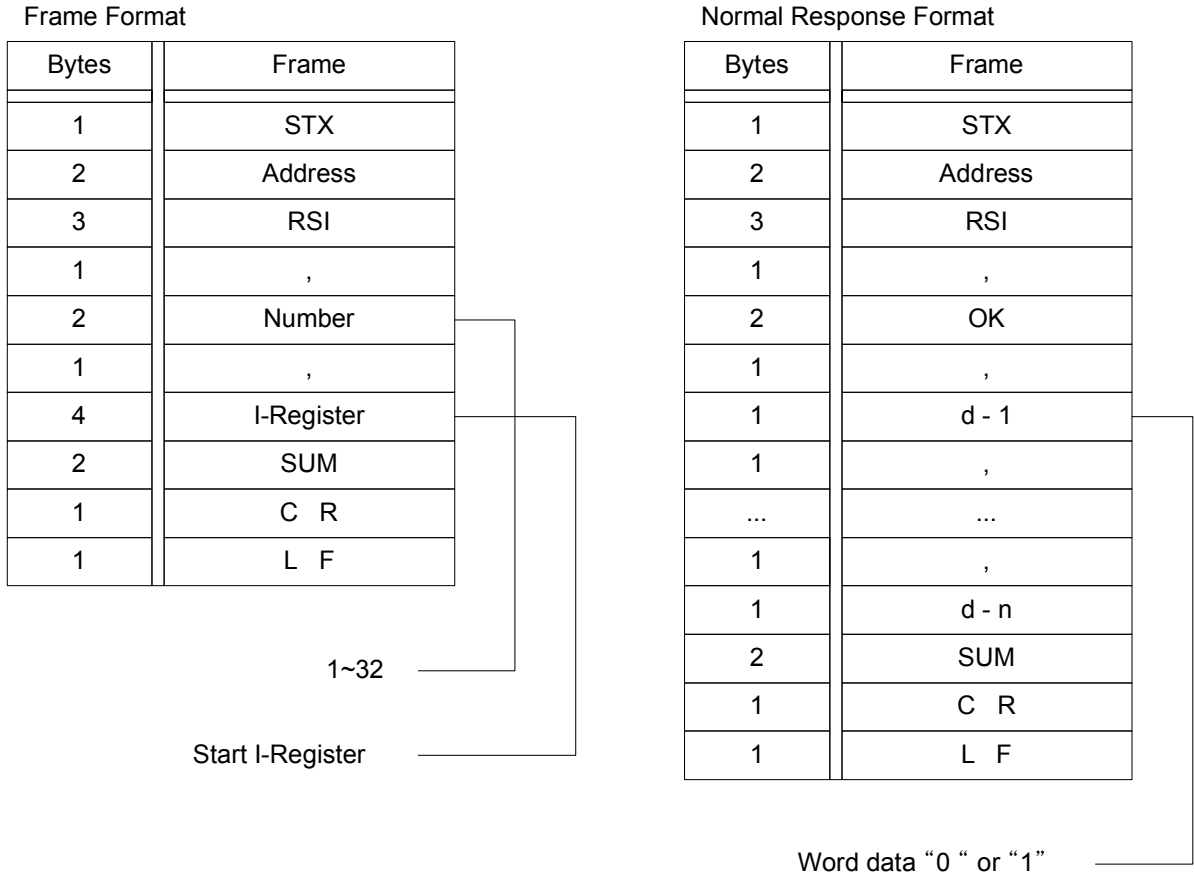
- Transmission : [stx]01RRD,02,0001,0002[cr][lf]
- Transmission (Include Check Sum) : [stx]01RRD,02,0001,0002B2[cr][lf]

D0001=50.0 and D0002=30.0 then,

- Reception : [stx]01RRD,OK,01F4,012C[cr][lf]
- Reception (Include Check Sum) : [stx]01RRD,OK,01F4,012C18[cr][lf]

### (C) RSI Command

RSI is command for reading consecutive I-Register. Set the number of reading and the start I-Register No. on the Frame.



ex) When reading the I-Register from ALARM1(I0064) to ALARM3(I0066)

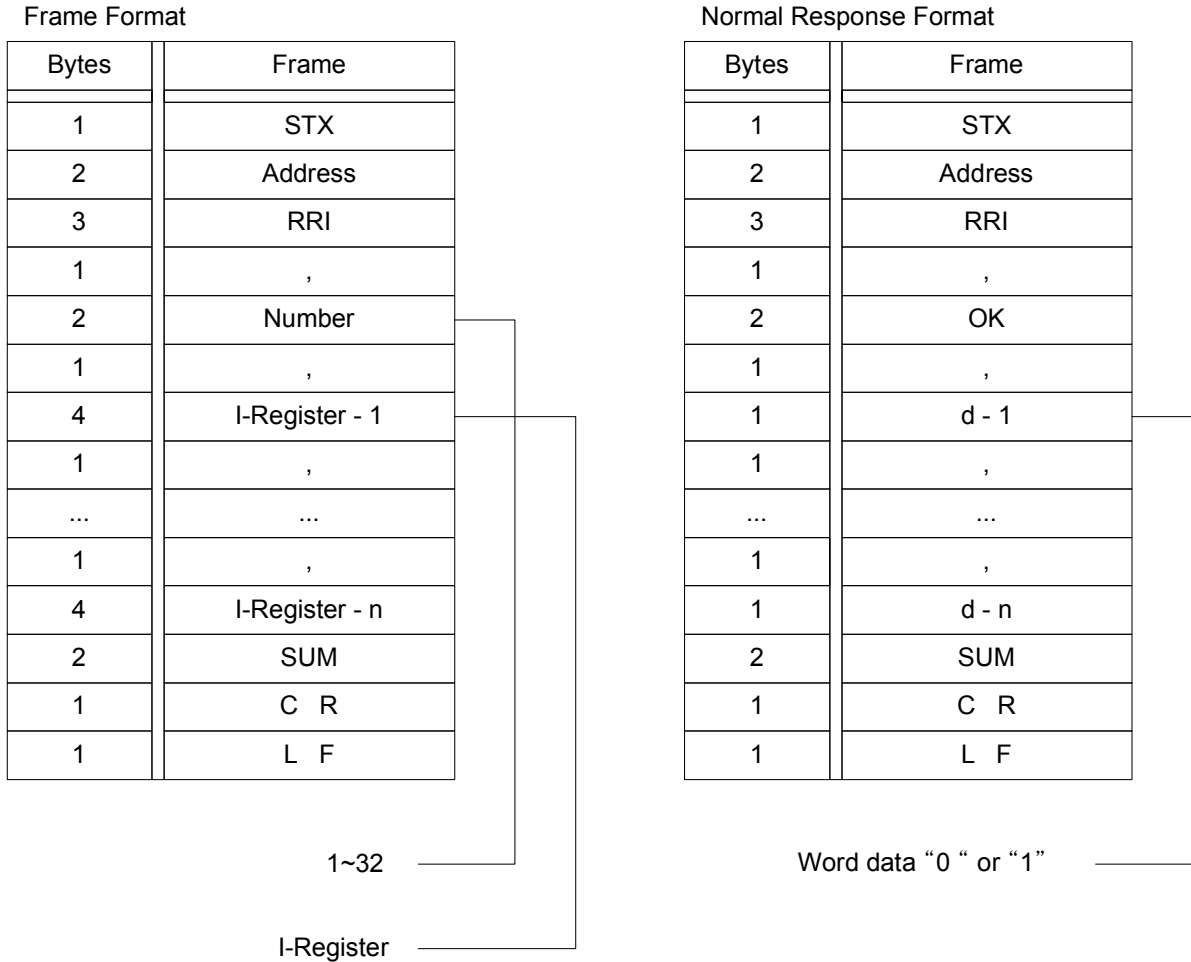
- Transmission : [stx]01RSI,03,0064[cr][lf]
- Transmission (Include Check Sum) : [stx]01RSI,03,0064D4[cr][lf]

When occur ALARM1, ALARM2 and ALARM3

- Reception : [stx]01RSI,OK,1,1,1[cr][lf]
- Reception (Include Check Sum) : [stx]01RSI,OK,1,1,12C[cr][lf]

### (D) RRI Command

RRI is command for reading random I-Register. Set the number of reading and each I-Register number.



ex) When reading the I-Register of ALARM1(I0064) to ALARM3(I0066)

- Transmission : [stx]01RRI,02,0064,0066[cr][lf]
- Transmission (Include Check Sum) : [stx]01RRI,02,0064,0066CA[cr][lf]

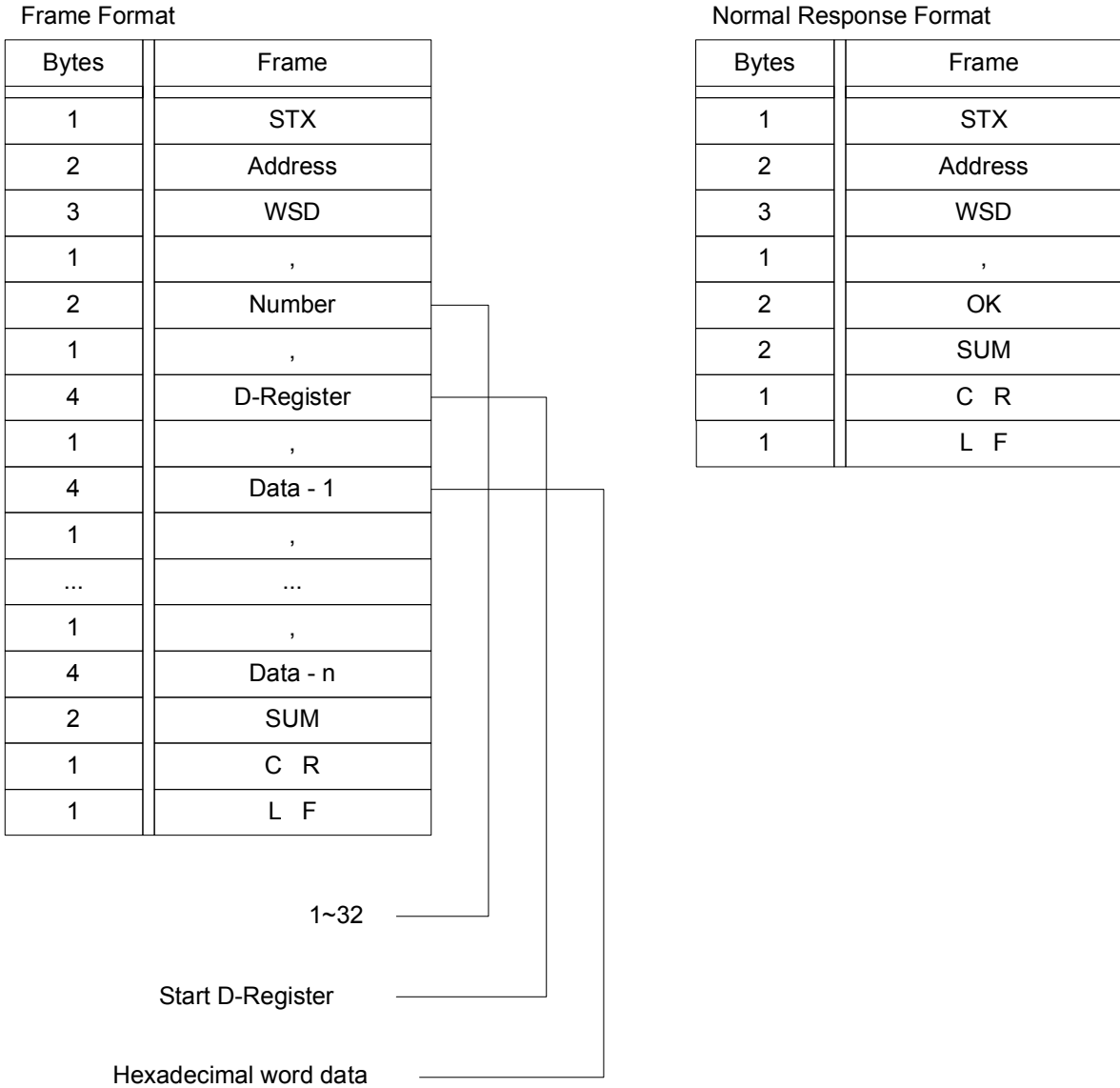
When occur ALARM1, ALARM2 and ALARM3

- Reception : [stx]01RRI,OK,1,1[cr][lf]
- Reception (Include Check Sum) : [stx]01RRI,OK,1,1CE[cr][lf]

### 4.2.2. Write Command

#### (A) WSD Command

WSDI is command for writing consecutive D-Register. Set the number of writing and the start D-Register No. on the Frame.



ex) When writing from ALT1(D0401) to ALT3(D0403)

- Transmission : [stx]01WSD,03,0401,0000,0000,0000[cr][lf]
- Transmission (Include Check Sum) : [stx]01WSD,03,0401,0000,0000,000093[cr][lf]

## (B) WRD Command

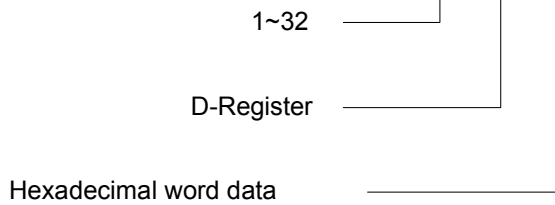
WRD is command for writing random D-Register. Set the number of writing and each D-Register number.

Frame Format

Bytes	Frame
1	STX
2	Address
3	WRD
1	,
2	Number
1	,
4	D-Register - 1
1	,
4	Data - 1
1	,
...	...
1	,
4	D-Register - n
1	,
4	Data - n
2	SUM
1	C R
1	L F

Normal Response Format

Bytes	Frame
1	STX
2	Address
3	WRD
1	,
2	OK
2	SUM
1	C R
1	L F



ex) When writing ALT1(D0401) and ALT3(D0403)

- Transmission : [stx]01WRD,02,0401,0001,0403,0001[cr][lf]
- Transmission (Include Check Sum) : [stx]01WRD,02,0401,0001,0403,00019A[cr][lf]

### (C) WSI Command

WSI is command for writing consecutive I-Register. Set the number of writing and the start I-Register No. on the Frame.

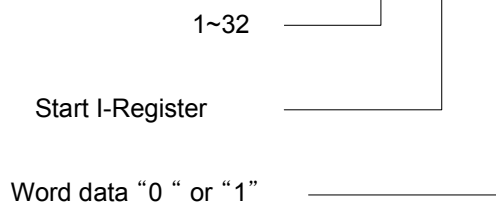
※ I-Register writing is available on Common Area only.

Frame Format

Bytes	Frame
1	STX
2	Address
3	WSI
1	,
2	Number
1	,
4	I-Register
1	,
1	d - 1
1	,
...	...
1	,
1	d - n
2	SUM
1	C R
1	L F

Normal Response Format

Bytes	Frame
1	STX
2	Address
3	WSI
1	,
2	OK
2	SUM
1	C R
1	L F



ex) Writing consecutive data on Common Area

- Transmission : [stx]01WSI,03,256,0,1,0[cr][lf]
- Transmission (Include Check Sum) : [stx]01WSI,03,256,0,1,0C1[cr][lf]

### (D) WRI Command

WRI is command for writing random I-Register. Set the number of writing and the start I-Register No. on the Frame.

※ I-Register writing is available on Common Area only.

Frame Format

Bytes	Frame
1	STX
2	Address
3	WRI
1	,
2	Number
1	,
4	I-Register - 1
1	,
1	d - 1
1	,
...	...
1	,
4	I-Register - n
1	,
1	d - n
2	SUM
1	C R
1	L F

1~32

I-Register

Hexadecimal word data

Normal Response Format

Bytes	Frame
1	STX
2	Address
3	WRI
1	,
2	OK
2	SUM
1	C R
1	L F

ex) Writing data randomly on Common Area

- Transmission : [stx]01WRI,03,256,1,258,1,260,0[cr][lf]

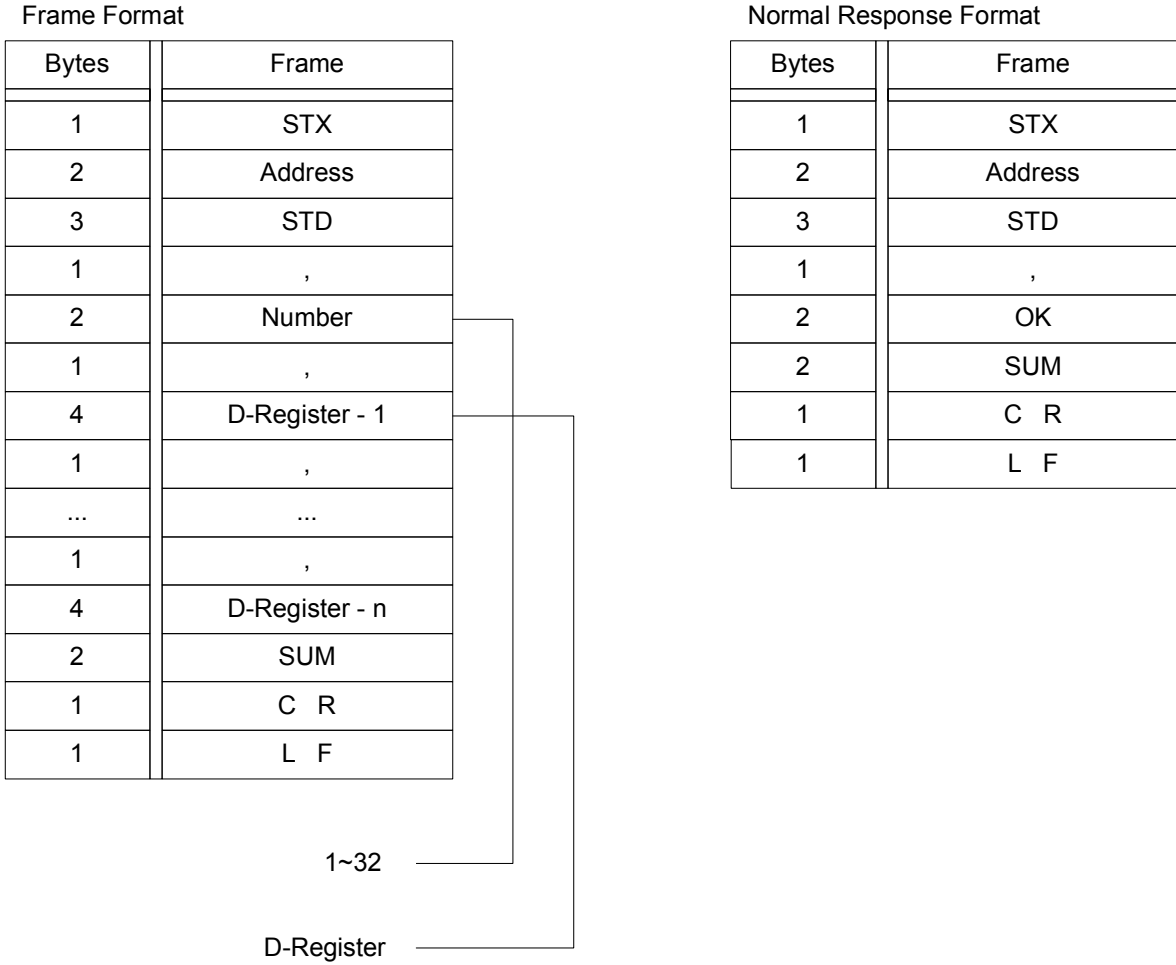
- Transmission (Include Check Sum) : [stx]01WRI,03,256,1,258,1,260,050[cr][lf]

### 4.2.3. Monitoring Command

#### (A) STD Command

STD is command for registration of D-Register for monitoring. Set the number of monitoring and the start D-Register No. on the Frame.

STD command is for registering monitoring, is reading resisted D-Register with CLD command.



ex) Registering data PV(D0001), SP(D0002)

- Transmission : [stx]01STD,02,0001,0002[cr][lf]
- Transmission (Include Check Sum) : [stx]01STD,02,0001,0002B5[cr][lf]

※ The registered (saved) data by Monitoring command is deleting after turn power off, so data should be re-register after turn power on again.



### (B) CLD Command

CLD is command for reading registered D-Register by STD command.

Frame Format

Bytes	Frame
1	STX
2	Address
3	CLD
2	SUM
1	C R
1	L F

Normal Response Format

Bytes	Frame
1	STX
2	Address
3	CLD
1	,
2	OK
1	,
4	Data - 1
1	,
...	...
1	,
4	Data - n
2	SUM
1	C R
1	L F

Hexadecimal word data

- ex) Reading registered D-Register by STD command
- Transmission : [stx]01CLD[cr][lf]
  - Transmission (Include Check Sum) : [stx]01CLD34[cr][lf]

### (C) STI Command

STI is command for registration of I-Register for monitoring. Set the number of monitoring and the start I-Register No. on the Frame.

STI command is for registering monitoring, is reading resisted I-Register with CLI command.

Frame Format

Bytes	Frame
1	STX
2	Address
3	STI
1	,
2	Number
1	,
4	I-Register - 1
1	,
...	...
1	,
4	I-Register - n
2	SUM
1	C R
1	L F

Normal Response Format

Bytes	Frame
1	STX
2	Address
3	STI
1	,
2	OK
2	SUM
1	C R
1	L F

ex) Registering ALARM1 to ALARM3

- Transmission : [stx]01STI,03,64,65,66[cr][lf]
- Transmission (Include Check Sum) : [stx]01STI,03,64,65,66A5[cr][lf]

### (D) CLI Command

CLI is command for reading registered I-Register by STI command.

Frame Format

Bytes	Frame
1	STX
2	Address
3	CLI
2	SUM
1	C R
1	L F

Normal Response Format

Bytes	Frame
1	STX
2	Address
3	CLI
1	,
2	OK
1	,
1	d - 1
1	,
...	...
1	,
1	d - n
2	SUM
1	C R
1	L F

Word data "0" or "1"

- ex) Reading registered D-Register by STD command
- Transmission : [stx]01CLI[cr][lf]
  - Transmission (Include Check Sum) : [stx]01CLI39[cr][lf]

### 4.3. Information Command

Information command is for information of NOVA

Frame Format

Bytes	Frame
1	STX
2	Address
3	AMI
2	SUM
1	C R
1	L F

Normal Response Format

Bytes	Frame
1	STX
2	Address
3	AMI
1	,
2	OK
1	,
10	Model Name(Size)
1	SPACE
7	Version-Revision
2	SUM
1	C R
1	L F

ex) Confirming NOVA information

- Transmission : [stx]01AMI[cr][lf]
- Transmission (Include Check Sum) : [stx]01AMI38[cr][lf]

ex) Confirming NOVA information

- Reception : [stx]01AMI,OK,ST59(9696)[sp]V00-R01[cr][lf]
- Reception (Include Check Sum) : [stx]01AMI,OK,ST59(9696)[sp]V00-R019F[cr][lf]

## 4.4. Error Code

When error is occurred on communicating, Nova is sending as under

Error Response Frame

Bytes	1	2	2	2	2	1	1
Frame	S T X	Address	NG	Error Code	SUM	C R	L F

Error Code	Descriptions	Remark
01	Define nonexistence command	
02	Define nonexistence register	
04	Data input Error	Input invalid data (Using only hexadecimal of 0~9, A~F)
08	Composite unacceptable format	- Different format with appointed command - Different number between appointed number and set number
11	Check sum error	
12	Monitoring command error	Non appointed Monitoring Command
14	Time out error	- The last character is not received within 30 seconds after received first character
00	Other error occur	

ex) When Transmitting nonexistence command

- Transmission : [stx]01RSF,03,0001[cr][lf]
- Transmission (Include Check Sum) : [stx]01RSF,03,0001C8[cr][lf]

- Reception : [stx]01NG01[cr][lf]
- Reception (Include Check Sum) : [stx]01NG0157[cr][lf]

## 5. MODBUS Protocol

Nova, there are two mode of MODBUS protocols, ASCII(COM.P = '3') and RTU(COM.P = '4')

### (A) Data Format

Items	ASCII	RTU
Start of text	: (Colon)	None
End of text	CR+LF	None
Data length	7-bit (Fix)	8-bit (Fix)
Data format	ASCII	Binary
Error finding	LRC (Longitudinal Redundancy Check)	CRC-16 (Cyclic Redundancy Check)
Data time period	No more than 1 sec	No more than 24-bit hours

### (B) Frame format

- Modbus ASCII

Start of text	Address	Function code	Data	CRC Check	End of text
1 text	2 text	2 text	n text	2 text	2text(CR+LF)

- Modbus RTU

Start of text	Address	Function code	Data	CRC Check	End of text
None	8-bit	8-bit	n * 8-bit	16-bit	None

## 5.1. Communication Function Code

MODBUS communication function code of NOVA are consist of function code of Read/Write for D-Register and function code for detect Loop-Back.

Function code	Descriptions
03	Keep on reading D-Register
06	One D-Register Write
08	Diagnostics(Loop-Back Test)
16	D-Register 연속 Write

### 5.1.1. Function code - 03

Function code-03 can reading D-Register up to 32 pcs.

#### Frame Format

Descriptions	ASCII	RTU
Start of text	: (Colon)	None
Address	2 Text	8-bit
Function code-03	2 Text	8-bit
D-Register Hi	2 Text	8-bit
D-Register Lo	2 Text	8-bit
No. of read Hi	2 Text	8-bit
No. of read Lo	2 Text	8-bit
Error detect	2 Text	16-bit
End of text	2 Text(CR+LF)	None

#### Response Format

Descriptions	ASCII	RTU
Start of text	:(Colon)	None
Address	2 Text	8-bit
Function code-03	2 Text	8-bit
No. of None Byte	2 Text	8-bit
Data-1 Hi	2 Text	8-bit
Data-1 Lo	2 Text	8-bit
...	...	...
Data-n Hi	2 Text	8-bit
Data-n Lo	2 Text	8-bit
Error detect	2 Text	16-bit
End of text	2 Text(CR+LF)	None

## 5.1.2. Function code - 06

Function code-06 can writing D-Register only 1 pcs.

### Frame Format

Descriptions	ASCII	RTU
Start of text	: (Colon)	None
Address	2 Text	8-bit
Function code-06	2 Text	8-bit
D-Register Hi	2 Text	8-bit
D-Register Lo	2 Text	8-bit
Write Data Hi	2 Text	8-bit
Write Data Lo	2 Text	8-bit
Error detect	2 Text	16-bit
End of text	2 Text(CR+LF)	None

### Response Format

Descriptions	ASCII	RTU
Start of text	: (Colon)	None
Address	2 Text	8-bit
Function code-06	2 Text	8-bit
D-Register Hi	2 Text	8-bit
D-Register Lo	2 Text	8-bit
Write Data Hi	2 Text	8-bit
Write Data Lo	2 Text	8-bit
Error detect	2 Text	16-bit
End of text	2 Text(CR+LF)	None



### 5.1.3. Function code - 08

Function code-08 is using self diagnosis.

#### Frame Format

Descriptions	ASCII	RTU
Start of text	: (Colon)	None
Address	2 Text	8-bit
Function code-08	2 Text	8-bit
Detect code Hi	2 Text	8-bit
Detect code Lo	2 Text	8-bit
Data Hi	2 Text	8-bit
Data Lo	2 Text	8-bit
Error detect	2 Text	16-bit
End of text	2 Text(CR+LF)	None

#### Response Format

Descriptions	ASCII	RTU
Start of text	: (Colon)	None
Address	2 Text	8-bit
Function code-08	2 Text	8-bit
Detect code Hi	2 Text	8-bit
Detect code Lo	2 Text	8-bit
Data Hi	2 Text	8-bit
Data Lo	2 Text	8-bit
Error detect	2 Text	16-bit
End of text	2 Text(CR+LF)	None

※ Detect code and descriptions

Detect code	Descriptions
Start of text	Loop-Back Test : Reception Frame Return

### 5.1.4. Function code - 16

Function code-16 can writing consecutive D-Register up to 16 pcs.

#### Frame Format

Descriptions	ASCII	RTU
Start of text	: (Colon)	None
Address	2 Text	8-bit
Function code-16	2 Text	8-bit
D-Register Hi	2 Text	8-bit
D-Register Lo	2 Text	8-bit
No. of write Hi	2 Text	8-bit
No. of write Lo	2 Text	8-bit
No. of data Byte	2 Text	8-bit
Data-1 Hi	2 Text	8-bit
Data-1 Lo	2 Text	8-bit
...	...	...
Data-n Hi	2 Text	8-bit
Data-n Lo	2 Text	8-bit
Error detect	2 Text	16-bit
End of text	2 Text(CR+LF)	None

#### Response Format

Descriptions	ASCII	RTU
Start of text	: (Colon)	None
Address	2 Text	8-bit
Function code-16	2 Text	8-bit
D-Register Hi	2 Text	8-bit
D-Register Lo	2 Text	8-bit
No. of write Hi	2 Text	8-bit
No. of write Lo	2 Text	8-bit
Error detect	2 Text	16-bit
End of text	2 Text(CR+LF)	None

## 5.2. Error Code

Error Code is returned when received frame has error.

### Frame Format

Descriptions	ASCII	RTU
Start of text	: (Colon)	None
Address	2 Text	8-bit
Function code	2 Text	8-bit
Error code	2 Text	8-bit
Error detect	2 Text	16-bit
End of text	2 Text(CR+LF)	None

※ Error code and descriptions

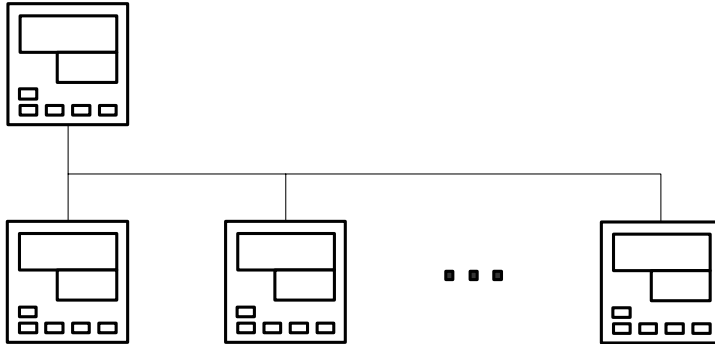
Detect code	Descriptions
01	Wrong function code
02	Wrong sett D-Register
08	Error of set No. of data

※ The reason for No Response

- Overrun, Framing Error, Parity Error, LRC Error, CRC Error
- Wrong Address
- The time is more than 1 sec between frame text
- Broadcast communication

## 6. SYNC Communication

A system of SYNC communication (coordinated operation) is configured with a master controller(COM.P='4') and a number of slave (Up to 31 units) controllers(COM.P='5'), all of which are Nova Series controllers. The slave controllers are set to operate in the same way as the master controller. This time running information(Run/Stop, SP) is transmitting to Slave controller(s) from Master controller.



### (A) SYNC-Master

- SYNC-Master Model only

SYNC-Master is available on SP96, ST96, ST48, ST72 and ST44

- Reception Frame

SYNC, a, b, c[CR][LF]

Items	Descriptions
a	STOP(0) / RUN(1)
b	Present SP (Include decimal point)
c	Check Sum

### (B) SYNC-Slave

- SYNC-Slave Model only

SYNC-Slave is available on SP96, ST48, ST72 and ST44

- How to set SYNC-Slave mode

SYNC-Slave mode → COM.P = '5' then set SPSL = 'C.SP'(5)

※ No response for received frame.

## 7. BROADCAST MODE

Broadcast mode is for transmitting information to Nova with is connected higher-level Device for doing same operating. This time, Nova is not transmitting response.

In the command, specify the broadcast address "00" and execute it.

※ Applicable only for write command

※ Applicable only for 'Standard protocol', 'Standard protocol + Check Sum', 'Modbus ASCII' and 'Modbus RTU'

## 8. D-Register

D-Register is the group of data for check the state of Nova by communication and the group is consist of 100 register. The contents of the D-Register mapping table are classified as under.

D-Register Range	Group Name	Descriptions	Read	Write
D0000~D0099	PROCESS	Basic operating information parameter	O	O
D0100~D0199	FUNCTION	Operation and function parameter	O	O
D0200~D0299	SET POINT	SP parameter	O	O
D0300~D0399	SIGNAL	Inner Signal parameter	O	O
D0400~D0499	ALARM	Alarm parameter	O	O
D0500~D0599	PID	P.I.D parameter	O	O
D0600~D0699	IN/OUT	Input and output parameter	O	
D0700~D0799	RESERVED	Unused area	x	x
D0800~D0899	RESERVED	Unused area	x	x
D0900~D0999	RESERVED	Unused area	x	x
D1000~D1099	PT INFO	Program pattern information parameter	O	O
D1100~D1199	PT1	Program pattern parameter	O	O
D1200~D1299	PT2	Program pattern parameter	O	O
D1300~D1399	RESERVED	Unused area	x	x

## 8.1. Process

Process group is consist of basic data from running time and there is Bit Map information which is show state, see the <Enclosure> for more information.

D-Register	Items	Model	Descriptions
D0001	NPV	All model	Present PV
D0002	NSP	SP, ST, SL	Present SP
D0003	TSP	SPxx	Target set point (TSP)
D0005	SPSL	STxx	Running SP number
D0006	MVOUT	SPxx, STxx	Manipulation output value (MV)
D0007	HOUT	STxx	Heating MV
D0008	COU	STxx	Cooling output
D0009	PIDNO	SPxx, STxx	Present running P.I.D number
D0010	NOWSTS	SPxx, STxx	Present run state
D0014	ALSTS	All model	Present Alarm state
D0017	SIGNAL.STS	SPxx	Present Signal state
D0019	ERROR	All model	Present Error state
D0020	PROC.TIME	STxx	Processing time
D0022	PV.LO	SDxx	Minimum PV in history
D0023	PV.HI	SDxx	Maximum PV in history
D0025	PTNO	SPxx	Present Pattern number
D0026	SEG.NO	SPxx	Present Segment number
D0027	END.SEG.NO	SPxx	Total number of segment in present pattern
D0028	RUN.TIME	SPxx	Processing time for present segment
D0029	SET.TIME	SPxx	Set time for present segment
D0031	LINK.CODE	SPxx	Next step information after finish present pattern
D0032	RPT	SPxx	Total number of repeat from RST to REN
D0033	RST	SPxx	Number of start segment for repeat
D0034	REN	SPxx	Number of last segment for repeat
D0036	WAIT.TIME	SPxx	The time after wait function
D0038	HI.VALUE	SLxx	Maximum PV when HI.LO = HIGH
D0039	LO.VALUE	SLxx	Maximum PV when HI.LO = LOW
D0040	KEEP.TIME	SLxx	Turn ON time for "OVER" LAMP

## 8.2. Function

FUNCTION is consist of D-Register for operation.

D-Register	Items	Model	Descriptions
D0101	R-S,STOP/RUN	STxx	Set present state for RUN or STOP
D0105	A/M	STxx	Set AUTO/MANUAL for control state
D0106	H.OUT(MVOUT)	STxx	Heating output for manual run
D0107	C.OUT(MVOUTc)	STxx	Cooling output for manual run
D0111	F.KEY,RST/P1/P2	SPxx	Set pattern for running
D0112	HOLD,OFF/ON	SPxx	Hold present running segment
D0113	STEP,OFF/ON	SPxx	Move to next segment and running
D0121	AT	SPxx, STxx	Set execution Auto Tuning
D0122	AT-G	SPxx, STxx	Using PID value proportionately
D0131	S-TM	STxx	Set waiting time for reservation run in reserve mode
D0132	P-TM	STxx	Set running time
D0133	PE-TM	SPxx	Set the time for signal for pattern end
D0134	ON/OFF	STxx	Set On/Off control
D0135	US1	SP, ST, SD	Register user screen
D0136	US2	SP, ST, SD	Register user screen
D0137	LOCK	All model	Lock on for prohibit change parameter
D0138	DI.SL	SP, ST, SD	Set changing control state by digital input (DI)
D0139	DSP.H	SP, ST, SD	Set the range-hi for sensor input value on PV screen
D0140	DSP.L	SP, ST, SD	Set the range-low for sensor input value on PV screen
D0141	HI.LO	SLxx	Set the state for High Limit or Low Limit
D0142	R.MD	SLxx	Set relay out when turn power on

## 8.3. Set Point

Set Point group is consist of D-Register for SP setting.

D-Register	Items	Model	Descriptions
D0200	SPSL	STxx	Set type of SP for running
D0201	SP1	STxx, SLxx	Set SP1 for running
D0202	SP2	STxx	Set SP2 for running
D0203	SP3	STxx	Set SP3 for running
D0204	SP4	STxx	Set SP4 for running
D0211	SPRH	STxx, SLxx	Set range-high
D0212	SPRL	STxx, SLxx	Set range-low
D0214	TMU	STxx, SLxx	Set Time unit
D0216	U.SLP	STxx	Increase SP with time proportionately
D0217	D.SLP	STxx	Decrease SP with time proportionately



## 8.4. Signal

Signal group is consist of D-Register for Inner signal setting.

D-Register	Items	Model	Descriptions
D0301	1.IST	SPxx	Set item for Inner Signal1 running
D0302	1.ISB	SPxx	Set direct for Inner Signal1 running zone
D0303	1.ISH	SPxx	Set range-high for Inner Signal1 zone
D0304	1.ISL	SPxx	Set range-low for Inner Signal1 zone
D0305	1.ISD	SPxx	Set delay time Inner Signal1 running
D0306	2.IST	SPxx	Set range-high for Inner Signal2 zone
D0307	2.ISB	SPxx	Set direct for Inner Signal2 running zone
D0308	2.ISH	SPxx	Set range-high for Inner Signal2 zone
D0309	2.ISL	SPxx	Set range-low for Inner Signal2 zone
D0310	2.ISD	SPxx	Set delay time Inner Signal2 running
D0311	DO1	SPxx	Set the DO1 function when DO Option selected
D0312	DO2	SPxx	Set the DO2 function when DO Option selected
D0313	DO3	SPxx	Set the DO3 function when DO Option selected
D0314	DO4	SPxx	Set the DO4 function when DO Option selected

## 8.5. Alarm

Alarm group is consist of D-Register for alarm setting.

D-Register	Items	Model	Descriptions
D0401	ALT1	All model	Set type of Alarm-1
D0402	ALT2	SP, ST, SD	Set type of Alarm-2
D0403	ALT3	SP, ST, SD	Set type of Alarm-3
D0406	AL-1	All model	Set the alarm point for ALT1
D0407	AL-2	SP, ST, SD	Set the alarm point for ALT2
D0408	AL-3	SP, ST, SD	Set the alarm point for ALT3
D0411	A1DB	All model	Set Dead Band(Hysterisis) for Alarm-1
D0412	A2DB	SP, ST, SD	Set Dead Band(Hysterisis) for Alarm-2
D0413	A3DB	SP, ST, SD	Set Dead Band(Hysterisis) for Alarm-3
D0416	A1DY	All model	Set delay time for Alarm-1
D0417	A2DY	SP, ST, SD	Set delay time for Alarm-2
D0418	A3DY	SP, ST, SD	Set delay time for Alarm-3
D0421	AL1.H	All model	Set range-high when ATL1 type is deviation alarm
D0422	AL2.H	SP, ST, SD	Set range-high when ATL2 type is deviation alarm
D0423	AL3.H	SP, ST, SD	Set range-high when ATL3 type is deviation alarm
D0426	AL1.L	All model	Set range-low when ATL1 type is deviation alarm
D0427	AL2.L	SP, ST, SD	Set range-low when ATL2 type is deviation alarm
D0428	AL3.L	SP, ST, SD	Set range-low when ATL3 type is deviation alarm

## 8.6. PID

PID group is consist of D-Register for PID setting.

D-Register	Items	Model	Descriptions
D0501	ARW	SPxx, STxx	Set deviation for excess integration prevention
D0502	FUZZY	SPxx, STxx	Set FUZZY function ON/OFF
D0511	1.P	SPxx, STxx	Set proportional act for PID1
D0512	1.I	SPxx, STxx	Set integration time for PID1
D0513	1.D	SPxx, STxx	Set differentiation time for PID1
D0514	1.MR	SPxx, STxx	Apply manually set value to PID1 integration time
D0515	1.Pc	STxx	Set proportional act for cooling PID1
D0516	1.Ic	STxx	Set integration time for PID1
D0517	1.Dc	STxx	Set differentiation time for cooling part PID1
D0518	1.DB	STxx	Set Dead Band for heat/cool zone on PID1
D0519	RP1	SPxx, STxx	Set reference point1
D0521	2.P	SPxx, STxx	Set proportional act for PID2
D0522	2.I	SPxx, STxx	Set integration time for PID2
D0523	2.D	SPxx, STxx	Set differentiation time for PID2
D0524	2.MR	SPxx, STxx	Apply manually set value to PID2 integration time
D0525	2.Pc	STxx	Set proportional act for cooling PID2
D0526	2.Ic	STxx	Set integration time for PID2
D0527	2.Dc	STxx	Set differentiation time for cooling part PID2
D0528	2.DB	STxx	Set Dead Band for heat/cool zone on PID2
D0529	RP2	SPxx, STxx	Set reference point2
D0531	3.P	SPxx, STxx	Set proportional act for PID3
D0532	3.I	SPxx, STxx	Set integration time for PID3
D0533	3.D	SPxx, STxx	Set differentiation time for PID3
D0534	3.MR	SPxx, STxx	Apply manually set value to PID3 integration time
D0535	3.Pc	STxx	Set proportional act for cooling PID3
D0536	3.Ic	STxx	Set integration time for PID3
D0537	3.Dc	STxx	Set differentiation time for cooling part PID3
D0538	3.DB	STxx	Set Dead Band for heat/cool zone on PID3
D0539	RHY	SPxx, STxx	Set PID hysteresis
D0541	4.P	SPxx, STxx	Set proportional act for PID4
D0542	4.I	SPxx, STxx	Set integration time for PID4
D0543	4.D	SPxx, STxx	Set differentiation time for PID4
D0544	4.MR	SPxx, STxx	Apply manually set value to PID4 integration time
D0545	4.Pc	STxx	Set proportional act for cooling PID4
D0546	4.Ic	STxx	Set integration time for PID4
D0547	4.Dc	STxx	Set differentiation time for cooling part PID4
D0548	4.DB	STxx	Set Dead Band for heat/cool zone on PID4
D0549	RDV	SPxx, STxx	Set reference deviation

## 8.7. IN/OUT

IN/OUT group is consist of D-Register for input and control output setting.

D-Register	Items	Model	Descriptions
D0601	IN-T	All model	Set sensor input type
D0602	IN-U	All model	Set display unit °C/ °F
D0603	IN.RH	All model	Set range-high of sensor input
D0604	IN.RL	All model	Set range-lovhigh of sensor input
D0605	IN.DP	All model	Set decimal point position for PV
D0606	IN.SH	All model	Set scale range-high for PV
D0607	IN.SL	All model	Set scale range-low for PV
D0608	IN.FL	All model	Set PV filter
D0609	BSL	All model	Set direct PV on sensor-open
D0610	RSL	All model	Set RJC ON/OFF when sensor type is PT
D0611	BSP1	All model	Set BIAS zone1 for setting bias for PV
D0612	BSP2	All model	Set BIAS zone2 for setting bias for PV
D0613	BSP3	All model	Set BIAS zone3 for setting bias for PV
D0615	BS0	All model	Set PV BIAS value for IN.RL
D0616	BS1	All model	Set PV BIAS for BIAS zone1
D0617	BS2	All model	Set PV BIAS for BIAS zone2
D0618	BS3	All model	Set PV BIAS for BIAS zone3
D0619	BS4	All model	Set PV BIAS value for IN.RH
D0621	OUT1	All model	Set atcing OUT1(RELAY output)
D0622	OUT2	SPxx, STxx	Set atcing OUT2(4~20mA/PULSE)
D0623	OUT3	SPxx, STxx	Set atcing OUT3(4~20mA/PULSE)
D0625	SUB1	SPxx, STxx	Set atcing SUB1(RELAY output)
D0626	SUB2	SPxx, STxx	Set atcing SUB2(RELAY output)
D0631	HEAT2	SPxx, STxx	Set output type for OUT2(Heating)
D0632	COOL2	STxx	Set output type for OUT2(Cooling)
D0633	HEAT3	SPxx, STxx	Set output type for OUT3(Heating)
D0634	COOL3	STxx	Set output type for OUT2(Cooling)
D0636	O.ACT	SLxx	Set control output direct REV/FWD
D0637	O.ACT	SPxx, STxx	Set control output direct REV/FWD
D0638	CT	SPxx, STxx	Set cycle of output ON/OFF
D0639	CTc	STxx	Set cycle of output ON/OFF for cooling
D0641	OH	SPxx, STxx	Set rang-high for control output
D0642	OL	SPxx, STxx	Set rang-low for control output
D0644	HYS	STxx	Set hysteresis when control output type is ON/OFF
D0645	HYS	SLxx	Set hysteresis when control output type is ON/OFF
D0646	PO	SPxx, STxx	Set preset output value for emergency
D0647	POc	STxx	Set preset cooling output value for emergency
D0648	HYS.H	STxx	Set range-high for hysteresis
D0649	HYS.L	STxx	Set range-low for hysteresis
D0651	RET	All model	Set type of transmit output
D0652	RETH	All model	Set range-high for transmit output
D0653	RETL	All model	Set range-low for transmit output

D-Register	Items	Model	Descriptions
D0661	COM.P	All model	Set communication protocol
D0662	BAUD	All model	Set baud rate
D0663	PRTY	All model	Set parity
D0664	SBIT	All model	Set stop bit
D0665	DLEN	All model	Set data length
D0666	ADDR	All model	Set address
D0667	RP.TM	All model	Set response time

## 8.8. PT\_Info

PT\_Info group is consist of D-Register for program pattern information setting.

D-Register	Items	Model	Descriptions
D1001	TMU	SPxx	Set time unit for program pattern
D1002	STC	SPxx	Set how to start program running with SP
D1003	WZ	SPxx	Set wait function and wait zone
D1004	WTM	SPxx	Set wait time for wait function

## 8.9. PT1/PT2

PT1/PT2 group is consist of D-Register for program pattern setting.

D-Register	Items	Model	Descriptions
D1101	1.LC	SPxx	Set next step after program running finish
D1102	1.SSP	SPxx	Set SP when program pattern running start
D1104	1.SP1	SPxx	Set TSP (Target SP) for segment-1
D1105	1.TM1	SPxx	Set running time for segment-1
D1106	1.TS1	SPxx	Set time signal ON/OFF for segment-1
...	...	...	...
D1146	1.SPF	SPxx	Set TSP (Target SP) for segment-15
D1147	1.TMF	SPxx	Set running time for segment-15
D1148	1.TSF	SPxx	Set time signal ON/OFF for segment-15
D1151	1.SSP	SPxx	Set segment repeat time for program running
D1152	1.RST	SPxx	Set last segment number for repeat
D1153	1.REN	SPxx	Set start segment number for repeat

※ Program pattern-2(PT2) is go through same as program pattern-1(PT1)

\* D-Register 0000~0499

NO.	PROCESS		FUNCTION		SET POINT		SIGNAL		ALARM	
	0	Model	100	Model	200	Model	300	Model	400	Model
0					SPSL	STxx				
1	NPV	All model	R-S <sub>STOP/RUN</sub>	STxx	SP1	STxx,SLxx	1.IST	SPxx	ALT1	All model
2	NSP	SP,ST,SL			SP2	STxx	1.ISB	SPxx	ALT2	SP,ST,SD
3	TSP	SPxx			SP3	STxx	1.ISH	SPxx	ALT3	SP,ST,SD
4					SP4	STxx	1.ISL	SPxx		
5	SPSL	STxx	A/M	STxx			1.ISD	SPxx		
6	MVOUT	SPxx,STxx	H.OUT <sub>(MVOUT)</sub>	STxx			2.IST	SPxx	AL-1	All model
7	HOUT	STxx	C.OUT <sub>(MVOUTc)</sub>	STxx			2.ISB	SPxx	AL-2	SP,ST,SD
8	COUT	STxx					2.ISH	SPxx	AL-3	SP,ST,SD
9	PIDNO	SPxx,STxx					2.ISL	SPxx		
10	NOWSTS	SP,ST,SL					2.ISD	SPxx		
11			F.KEY <sub>,RST/P1/P2</sub>	SPxx	SPRH	STxx,SLxx	DO1	SPxx	A1DB	All model
12			HOLD <sub>,OFF/ON</sub>	SPxx	SPRL	STxx,SLxx	DO2	SPxx	A2DB	SP,ST,SD
13			STEP <sub>,OFF/ON</sub>	SPxx			DO3	SPxx	A3DB	SP,ST,SD
14	ALSTS	All model			TMU	STxx,SLxx	DO4	SPxx		
15										
16					U.SLP	STxx			A1DY	All model
17	SIGNAL.STS	SPxx			D.SLP	STxx			A2DY	SP,ST,SD
18									A3DY	SP,ST,SD
19	ERROR	All model								
20	PROC_TIME	STxx								
21			AT	SPxx,STxx					AL1.H	All model
22	PV.LO	SDxx	AT-G	SPxx,STxx					AL2.H	SP,ST,SD
23	PV.HI	SDxx							AL3.H	SP,ST,SD
24										
25	PTNO	SPxx								
26	SEG.NO	SPxx							AL1.L	All model
27	END.SEG.NO	SPxx							AL2.L	SP,ST,SD
28	RUN.TIME	SPxx							AL3.L	SP,ST,SD
29	SET.TIME	SPxx								
30										
31	LINK.CODE	SPxx	S-TM	STxx						
32	RPT	SPxx	P-TM	STxx						
33	RST	SPxx	PE-TM	SPxx						
34	REN	SPxx	ON/OFF	STxx						
35			US1	SP,ST,SD						
36	WAIT.TIME	SPxx	US2	SP,ST,SD						
37			LOCK	All model						
38	HI.VALUE	SLxx	DI.SL	SP,ST,SD						
39	LO.VALUE	SLxx	DSP.H	SP,ST,SD						
40	KEEP.TIME	SLxx	DSP.L	SP,ST,SD						
41			HI.LO	SLxx						
42			R.MD	SLxx						
43										
44										
45										
46										
47										
48										
49										

NO.	PROCESS		FUNCTION		SET POINT		SIGNAL		ALARM	
	0	Model	100	Model	200	Model	300	Model	400	Model
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
60										
61										
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63										
64										
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66										
67										
68										
69										
70										
71										
72										
73										
74	User Area	All model								
75										
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78										
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98										
99										

\* D-Register 0500~0999

NO.	PID		IN/OUT		RESERVED		RESERVED		RESERVED	
	500	Model	600	Model	700	Model	800	Model	900	Model
0										
1	ARW	SPxx,STxx	IN-T	All model						
2	FUZZY	SPxx,STxx	IN-U	All model						
3			IN.RH	All model						
4			IN.RL	All model						
5			IN.DP	All model						
6			IN.SH	All model						
7			IN.SL	All model						
8			IN.FL	All model						
9			BSL	All model						
10			RSL	All model						
11	1.P	SPxx,STxx	BSP1	All model						
12	1.I	SPxx,STxx	BSP2	All model						
13	1.D	SPxx,STxx	BSP3	All model						
14	1.MR	SPxx,STxx								
15	1.Pc	STxx	BS0	All model						
16	1.Ic	STxx	BS1	All model						
17	1.Dc	STxx	BS2	All model						
18	1.DB	STxx	BS3	All model						
19	RP1	SPxx,STxx	BS4	All model						
20										
21	2.P	SPxx,STxx	OUT1	SPxx,STxx						
22	2.I	SPxx,STxx	OUT2	SPxx,STxx						
23	2.D	SPxx,STxx	OUT3	SPxx,STxx						
24	2.MR	SPxx,STxx								
25	2.Pc	STxx	SUB1	SPxx,STxx						
26	2.Ic	STxx	SUB2	SPxx,STxx						
27	2.Dc	STxx								
28	2.DB	STxx								
29	RP2	SPxx,STxx								
30										
31	3.P	SPxx,STxx	HEAT2	SPxx,STxx						
32	3.I	SPxx,STxx	COOL2	STxx						
33	3.D	SPxx,STxx	HEAT3	SPxx,STxx						
34	3.MR	SPxx,STxx	COOL3	STxx						
35	3.Pc	STxx								
36	3.Ic	STxx	O.ACT	SLxx						
37	3.Dc	STxx	O.ACT	SPxx,STxx						
38	3.DB	STxx	CT	SPxx,STxx						
39	RHY	SPxx,STxx	CTc	STxx						
40										
41	4.P	SPxx,STxx	OH	SPxx,STxx						
42	4.I	SPxx,STxx	OL	SPxx,STxx						
43	4.D	SPxx,STxx								
44	4.MR	SPxx,STxx	HYS	STxx						
45	4.Pc	STxx	HYS	SLxx						
46	4.Ic	STxx	PO	SPxx,STxx						
47	4.Dc	STxx	POc	STxx						
48	4.DB	STxx	HYS.H	STxx						
49	RDV	SPxx,STxx	HYS.L	STxx						

NO.	PID		IN/OUT		RESERVED		RESERVED		RESERVED	
	500	Model	600	Model	700	Model	800	Model	900	Model
50										
51			RET	All model						
52			RETH	All model						
53			RETL	All model						
54										
55										
56										
57										
58										
59										
60										
61			COM.P	All model						
62			BAUD	All model						
63			PRTY	All model						
64			SBIT	All model						
65			DLEN	All model						
66			ADDR	All model						
67			RP.TM	All model						
68										
69										
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99										



\* D-Register 1000~1399

NO.	PT INFO		PT1		PT2		RESERVED			
	1000	Model	1100	Model	1200	Model	1300	Model		
0										
1	TMU	SPxx	1.LC	SPxx	2.LC	SPxx				
2	STC	SPxx	1.SSP	SPxx	2.SSP	SPxx				
3	WZ	SPxx								
4	WTM	SPxx	1.SP1	SPxx	2.SP1	SPxx				
5			1.TM1	SPxx	2.TM1	SPxx				
6			1.TS1	SPxx	2.TS1	SPxx				
7			1.SP2	SPxx	2.SP2	SPxx				
8			1.TM2	SPxx	2.TM2	SPxx				
9			1.TS2	SPxx	2.TS2	SPxx				
10			1.SP3	SPxx	2.SP3	SPxx				
11			1.TM3	SPxx	2.TM3	SPxx				
12			1.TS3	SPxx	2.TS3	SPxx				
13			1.SP4	SPxx	2.SP4	SPxx				
14			1.TM4	SPxx	2.TM4	SPxx				
15			1.TS4	SPxx	2.TS4	SPxx				
16			1.SP5	SPxx	2.SP5	SPxx				
17			1.TM5	SPxx	2.TM5	SPxx				
18			1.TS5	SPxx	2.TS5	SPxx				
19			1.SP6	SPxx	2.SP6	SPxx				
20			1.TM6	SPxx	2.TM6	SPxx				
21			1.TS6	SPxx	2.TS6	SPxx				
22			1.SP7	SPxx	2.SP7	SPxx				
23			1.TM7	SPxx	2.TM7	SPxx				
24			1.TS7	SPxx	2.TS7	SPxx				
25			1.SP8	SPxx	2.SP8	SPxx				
26			1.TM8	SPxx	2.TM8	SPxx				
27			1.TS8	SPxx	2.TS8	SPxx				
28			1.SP9	SPxx	2.SP9	SPxx				
29			1.TM9	SPxx	2.TM9	SPxx				
30			1.TS9	SPxx	2.TS9	SPxx				
31			1.SPA	SPxx	2.SPA	SPxx				
32			1.TMA	SPxx	2.TMA	SPxx				
33			1.TSA	SPxx	2.TSA	SPxx				
34			1.SPB	SPxx	2.SPB	SPxx				
35			1.TMB	SPxx	2.TMB	SPxx				
36			1.TSB	SPxx	2.TSB	SPxx				
37			1.SPC	SPxx	2.SPC	SPxx				
38			1.TMC	SPxx	2.TMC	SPxx				
39			1.TSC	SPxx	2.TSC	SPxx				
40			1.SPD	SPxx	2.SPD	SPxx				
41			1.TMD	SPxx	2.TMD	SPxx				
42			1.TSD	SPxx	2.TSD	SPxx				
43			1.SPE	SPxx	2.SPE	SPxx				
44			1.TME	SPxx	2.TME	SPxx				
45			1.TSE	SPxx	2.TSE	SPxx				
46			1.SPF	SPxx	2.SPF	SPxx				
47			1.TMF	SPxx	2.TMF	SPxx				
48			1.TSF	SPxx	2.TSF	SPxx				
49										

NO.	PT INFO		PT1		PT2		RESERVED			
	1000	Model	1100	Model	1200	Model	1300	Model		
50										
51			1.RPT	SPxx	2.RPT	SPxx				
52			1.RST	SPxx	2.RST	SPxx				
53			1.REN	SPxx	2.REN	SPxx				
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\* BIT-MAP Information

NO.	PT INFO (D0010)		PT INFO (D0014)		PT INFO (D0017)		PT INFO (D0019)	
	0	STOP.RUN	STxx	ALARM1	All model	IS1	SPxx	
1			ALARM2	All model	IS2	SPxx		
2			ALARM3	All model	TS	SPxx		
3								
4	RESET	SPxx			ALM1	SPxx	AD.ERR	All model
5	PROG1	SPxx			ALM2	SPxx		
6	PROG2	SPxx			ALM3	SPxx		
7	HOLD	SPxx						
8	WAIT	SPxx			UP	SPxx	+OVER	All model
9	OVER	SLxx			DOWN	SPxx	-OVER	All model
10	OUT	SLxx			PEND	SPxx	B.OUT	All model
11								
12	AT	STxx,SPxx						
13	AUTO/MAN	STxx						
14								
15								

\* I-Relay Map

NO.	RELAY NAME	MODEL	NO.	RELAY NAME	MODEL	NO.	RELAY NAME	MODEL
0			48			96		
1			49			97		
2			50			98		
3			51			99		
4	AD.ERR	All model	52			100		
5			53			101		
6			54			102		
7			55			103		
8	+OVER	All model	56			104		
9	-OVER	All model	57			105		
10	B.OUT	All model	58			106		
11			59			107		
12			60			108		
13			61			109		
14			62			110		
15			63			111		
16	STOP.RUN	STxx	64	ALARM1	All model			
17			65	ALARM2	All model			
18			66	ALARM3	All model			
19			67					
20	RESET	SPxx	68					
21	PROG1	SPxx	69					
22	PROG2	SPxx	70					
23	HOLD	SPxx	71					
24	WAIT	SPxx	72					
25			73					
26			74					
27			75					
28	AT	SPxx,STxx	76					
29	AUTO/MAN	STxx	77					
30			78					
31			79					
32			80	IS1	SPxx	256	User Area	All model
33			81	IS2	SPxx	257	User Area	All model
34			82	TS	SPxx	258	User Area	All model
35			83			.	.	.
36			84	ALM1	SPxx	.	.	.
37			85	ALM2	SPxx	.	.	.
38			86	ALM3	SPxx	.	.	.
39			87			.	.	.
40			88	UP	SPxx	.	.	.
41			89	DOWN	SPxx	.	.	.
42			90	PEND	SPxx	.	.	.
43			91			.	.	.
44			92			.	.	.
45			93			319	User Area	All model
46			94			320	User Area	All model
47			95			321	User Area	All model