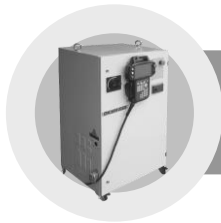




WARNING



**THE INSTALLATION SHALL BE MADE BY
QUALIFIED INSTALLATION PERSONNEL
AND SHOULD CONFORM TO ALL
NATIONAL AND LOCAL CODES**



Hi5 Controller Function Manual

Modbus





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1

Introduction



1. Introduction

Modbus

1.1. Prerequisite information

In order to understand this manual, the following prerequisite information is required

- Knowledge of Hi5 Robot controller's operation
- Knowledge of Hi5 embedded PLC relay
- Knowledge of Modbus protocol



1.2. Hi5 Robot controller's Modbus function

Hi5 Robot controller only supports the slave function of Modbus.

(1) MODBUS transmit mode

- ASCII mode
- RTU(binary) mode

(2) Supporting function

- 01: read coils (bits)
- 02: read discrete inputs (bits)
- 03: read holding registers (multiple)
- 04: read input registers (multiple)
- 05: write single coil (bit)
- 06: write single holding register
- 15: write coils (multiple bits)
- 16: write holding registers (multiple)

(3) Slave address setting

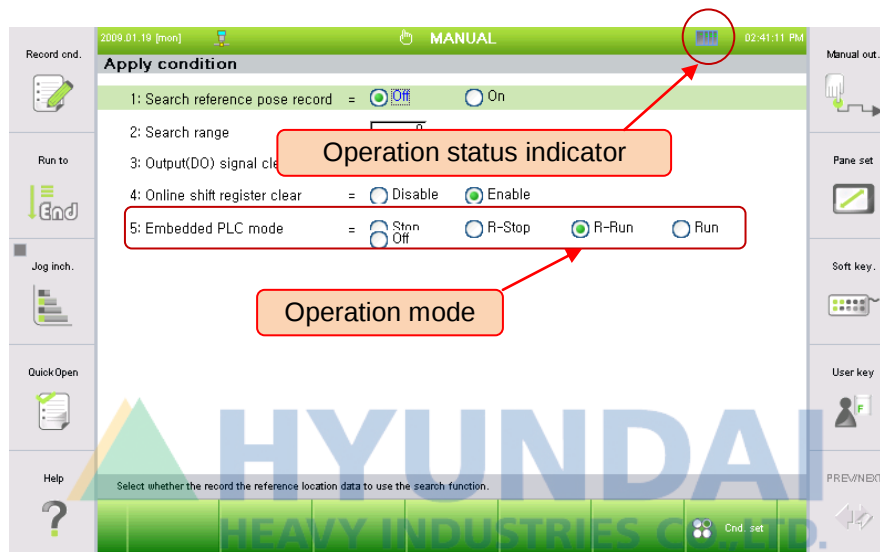
- Slave address: 1~247
- When command's slave address is 0, broadcasting function that activates all slaves regardless of the configured address is supported.

(4) Communication media

- CNSIO: RS232C/RS422/RS485 selective use → 1:1(RS232C/RS422), 1:N(RS485)
 - ① RS232C's pin array: No.2(TxD), 3(RxD), 5(GND) → Use PC and direct cable
 - ② RS422/RS485's pin array: 1(Tx), 6(/Tx), 4(Rx), 9(/Rx)
- OPSIO: RS232C/RS422/RS485 selective use → 1:1(RS232C/RS422), 1:N(RS485)
 - RS232C's pin array: No.3 (TxD), 2(RxD), 5(GND) → Use PC and cross cable
 - RS422/RS485's pin array: 1(Tx), 6(/Tx), 4(Rx), 9(/Rx)

(5) Use condition

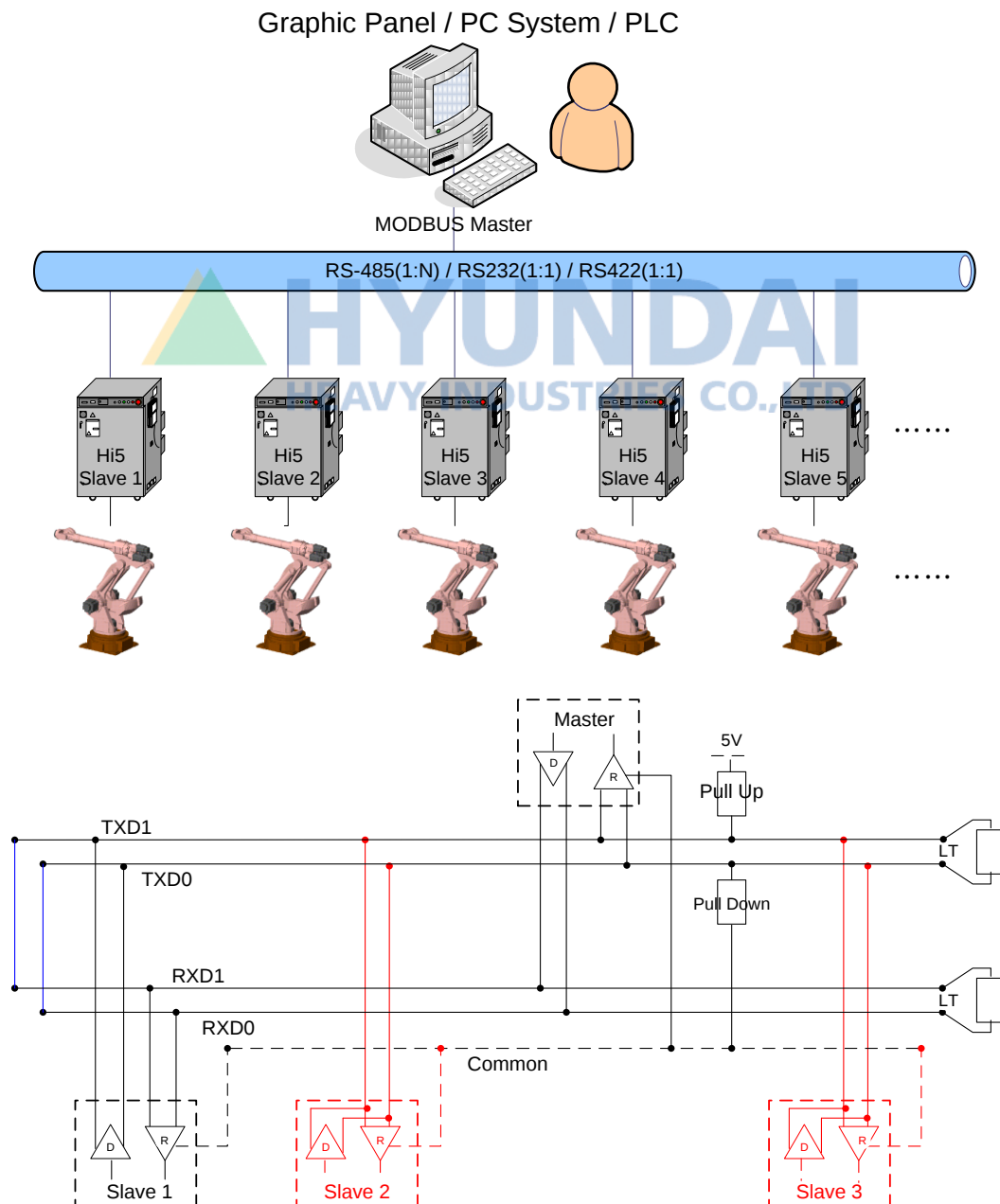
- TO use embedded PLC's Relay as MODBUS function, embedded PLC must be at Run status. (Note:Hi5's PLC enable can be configured at TP)
- PLC's operation mode setting can be configured at TP 『[F7]: Cnd. set』 → 『[F1]: App. cnd.』 as below



- If embedded PLC is disabled, Write on embedded PLC's Relay is not supported. However, read from all register or coil is still doable

(6) Example of MODBUS virtual management

- Operator function:
A robot of Low cost GP (Graphic Panel) or few robots that support Serial MODBUS can be connected with RS232/RS422/RS485 to use
- PLC communication:
Communication with PLC that has MODBUS Master function can be provided as a low cost solution
- PC Robot management system:
Robot management system that monitors or manages I/O signal of robot by using PC serial port can be constructed



(7) Hi5 Relay mapping

Modbus Data Model		Relay mapping: Refer to Hi5 relay configuration & IO data flow		Function
		1bit		
	Relay name	Register	Logical Add.	
Input Discrete Add: 0x0000~0xffff Quantity: 1~2039(bit) Input Registers Add: 0x0000~0xffff Quantity: 1~127	External Input	X1~8192	0x0001~0x2000	Read Function 02: read discrete Inputs (bits) 04: read input registers (multiple)
	PLC Input	DO1~4096	0x2001~0x3000	
	Fieldbus In #1	FB1.X1~960	0x3001~0x33C0	
	Fieldbus In #2	FB2.X1~960	0x3401~0x37C0	
	Fieldbus In #3	FB3.X1~960	0x3801~0x3BC0	
	Fieldbus In #4	FB4.X1~960	0x3C01~0x3FC0	
	CC-Link In	FB5.X1~256	0x4001~0x4100	
	Fieldbus Node In	FN1~64.X1~128	0x5001~0x8F80	
	Timer	T1~256	0xF001~0xF100	
	Counter	C1~256	0xF201~0xF300	
	Analog In			1000 magnification Data (ex, 6250→6.250)
Coils Add: 0x0000~0xffff Quantity: 1~2039(bit) Holding Registers Add: 0x0000~0xffff Quantity: 1~127	External Out	Y1~8192	0x0001~0x2000	Read Function 01: read coils (bits) 03: read holding registers (multiple) Write Function 05: write single coil (bit) 15: write coils (multiple bits) 06: write single holding register 16: write holding registers (multiple) AO: 1000 magnification Data (Range: ±12.000) System Memory is reserved
	PLC Out	DI1~4096	0x2001~0x3000	
	Fieldbus Out #1	FB1.Y1~960	0x3001~0x33C0	
	Fieldbus Out #2	FB2.Y1~960	0x3401~0x37C0	
	Fieldbus Out #3	FB3.Y1~960	0x3801~0x3BC0	
	Fieldbus Out #4	FB4.Y1~960	0x3C01~0x3FC0	
	CC-Link Out	FB5.Y1~256	0x4001~0x4100	
	Fieldbus Node Out	FN1~64.Y1~128	0x5001~0x8F80	
	Special	SP1~128	0x9101~0x9180	
	Auxiliary	R1~1024	0x9201~0x9600	
	Keep	K1~1024	0x9801~0x9C00	
	Timer			
	Counter			
	Analog Out			
	System Memory	SW1~512.1~16	0xA001~0xC000	
Shared Registers	Data Memory	MW1~1000.1~16	0xC001~0xFE80	
HRBASIC	V% variable			Data range: 0~255
	RN Register			
	V\$ variable			
	V! variable			36 bytes/V\$ → 40 x 36/2 = 720
				IEEE single-precision 32bit float point

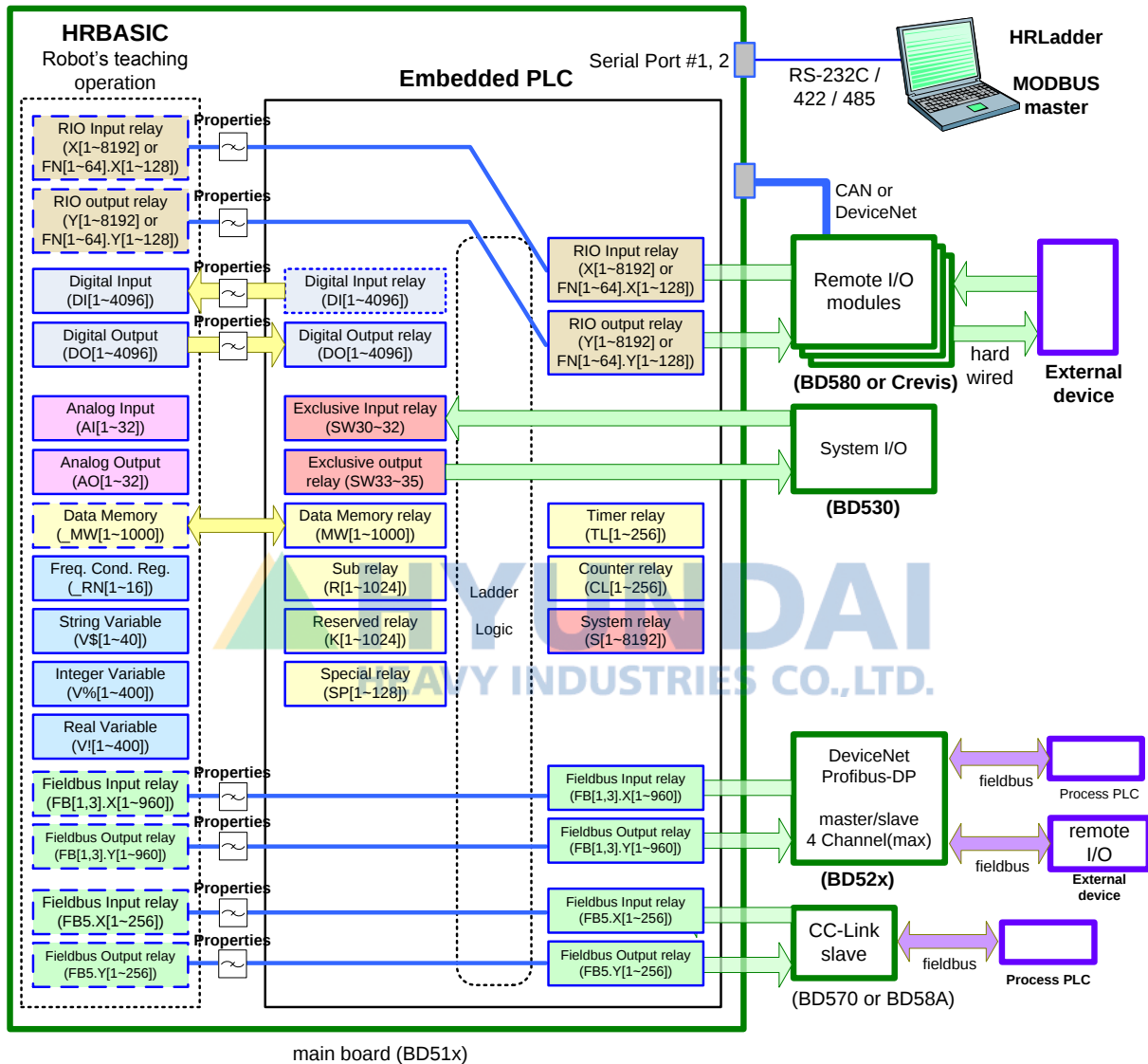
1. Introduction

Modbus Data Model		Relay mapping: Refer to Hi5 relay configuration & IO data flow					Function
		Register Prefix Name					
	Relay name	8bit	16bit	32bit	Float(32bit)	Logical Add.	
Input Discrete Add: 0x0000~0xffff Quantity: 1~2039(bit) Input Registers Add: 0x0000~0xffff Quantity: 1~127	External Input	XB1~1024	XW1~512	XL1~256	XF1~256	0x0001~0x0200	Read Function 02: read discrete Inputs (bits) 04: read input registers (multiple)
	PLC Input	DOB1~512	DOW1~256	DOL1~128	DOF1~128	0x2001~0x2100	
	Fieldbus In #1	FB1.XB1~120	FB1.XW1~60	FB1.XL1~30	FB1.XF1~30	0x3001~0x303C	
	Fieldbus In #2	FB2.XB1~120	FB2.XW1~60	FB2.XL1~30	FB2.XF1~30	0x3401~0x343C	
	Fieldbus In #3	FB3.XB1~120	FB3.XW1~60	FB3.XL1~30	FB3.XF1~30	0x3801~0x383C	
	Fieldbus In #4	FB4.XB1~120	FB4.XW1~60	FB4.XL1~30	FB4.XF1~30	0x3C01~0x3C3C	
	CC-Link In	FB5.XB1~32	FB5.XW1~16	FB5.XL1~8	FB5.XF1~8	0x4001~0x4010	
	Fieldbus Node In	FN1~64.XB1~16	FN1~64.XW1~8	FN1~64.XL1~4	FN1~64.XF1~4	0x5001~0x50F0	
	Timer						
	Counter						
	Analog In		AI1~32			0x9A01~0x9A20	1000 magnification Data(ex, 6250→6.250)
Coils Add: 0x0000~0xffff Quantity: 1~2039(bit) Holding Registers Add: 0x0000~0xffff Quantity: 1~127	External Out	YB1~1024	YW1~512	YL1~256	YF1~256	0x0001~0x0200	Read Function 01: read coils (bits) 03: read holding registers (multiple) Write Function 05: write single coil (bit) 15: write coils (multiple bits) 06: write single holding register 16: write holding registers (multiple) AO: 1000 magnification Data(Range: ±12.000) System Memory is reserved
	PLC Out	DIB1~512	DIW1~256	DIL1~128	DIF1~128	0x2001~0x2100	
	Fieldbus Out #1	FB1.YB1~120	FB1.YW1~60	FB1.YL1~30	FB1.YF1~30	0x3001~0x303C	
	Fieldbus Out #2	FB2.YB1~120	FB2.YW1~60	FB2.YL1~30	FB2.YF1~30	0x3401~0x343C	
	Fieldbus Out #3	FB3.YB1~120	FB3.YW1~60	FB3.YL1~30	FB3.YF1~30	0x3801~0x383C	
	Fieldbus Out #4	FB4.YB1~120	FB4.YW1~60	FB4.YL1~30	FB4.YF1~30	0x3C01~0x3C3C	
	CC-Link Out	FB5.YB1~32	FB5.YW1~16	FB5.YL1~8	FB5.YF1~8	0x4001~0x4010	
	Fieldbus Node Out	FN1~64.YB1~16	FN1~64.YW1~8	FN1~64.YL1~4	FN1~64.YF1~4	0x5001~0x50F0	
	Special	SPB1~16	SPW1~8	SPL1~4	SPF1~4	0x9001~0x9008	
	Auxiliary	RB1~128	RW1~64	RL1~32	RF1~32	0x9101~0x9140	
	Keep	KB1~128	KW1~64	KL1~32	KF1~32	0x9201~0x9240	
	Timer	TB1~1024	TW1~512	TL1~256	TF1~256	0x9301~0x9500	
	Counter	CB1~1024	CW1~512	CL1~256	CF1~256	0x9701~0x9900	
	Analog Out		AO1~32			0x9A01~0x9A20	
	System Memory	SB1~1024	SW1~512	SL1~256	SF1~256	0xA001~0xA200	
Shared Registers	Data Memory	MB1~2000	MW1~1000	ML1~500	MF1~500	0xA401~0xA7E8	
HRBASIC	V% variable		V%[1~400]			0xB001~0xB190	Data range: 0~255
	RN Register		RN1~16			0xC001~0xC010	
	V\$ variable	V\$[1~40]				0xD001~0xD2D0	
	V! variable				V![1~400]	0xE001~0xE320	IEEE single-precision 32bit float point

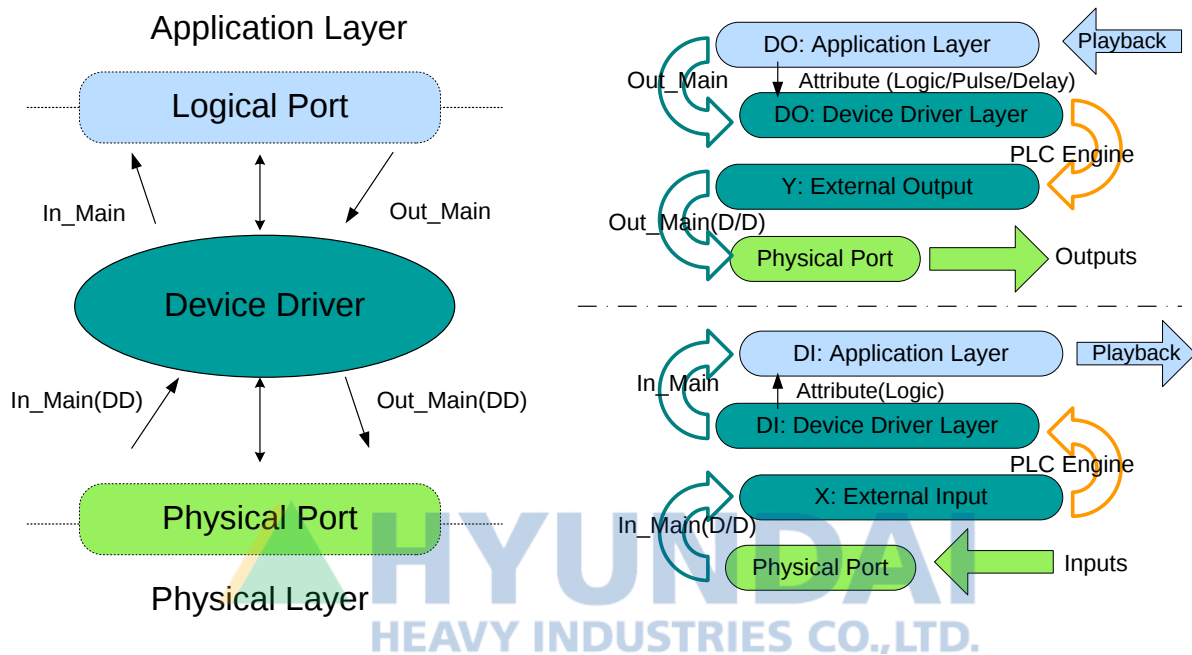
- The italic large numbers from above table are the relay group that used by Modbus.

- Data type: Float type uses IEEE single-precision 32bit float point, 8bit/16bit/32bit use all signed integers(except RN Register), for **8bit type, read only according to GP**
- **Relay's Endian uses Little Endian**
 Example, in case when Float type YF1=6.515625(0x40D08000),
 YL1=0x40D08000 → YW1=0x8000, YW2=0x40D0 → YB1=0x00, YB2=0x80, YB3=0xD0, YB4=0x40
 Note) Modbus transmit is 16 bit align's Big Endian. In other word, above transmission will occur in order of 0x80, 0x00, 0x40, 0xD0
- Hi4acontrast changes
 L(long)type and F(Float)type that are 31Bit type were added, number of AI/AO expanded (4→32), number of SP/SPB/SPW/SPL/SPF expanded(SPW: 2→8), number of SB/SW/SL/SF expanded(SW: 256→512), size of MB/MW/ML/MF reduced(MW: 5000→1000)
 Timer(Tn) and Counter(Cn)'s bit number has expanded(16bit→32bit); Cf) Tn(Cn) and TLn(CLn)'s relationship: If the value of TLn(CLn) is 0, Tn(Cn)=1(activation), if TLn(CLn) is not 0, then Tn(Cn) is 0.
 DI/DO, X/Y relay expansion: DI/DO1~256 → 1~4096, X/Y1~256 → 1~8192
 Quantity expansion: Bit=2000→2039, Reg=125→127
- Fieldbus Node In/Out: Address: For upper byte, Node number (1~64:0x50~0x8F, offset: 0x50) is assigned, for lower byte, address (bit: 1~128, word: 1~8) is assigned.
 Ex,
 FN1.X1~128: 0x5001~0x5080, FN2.X1~128: 0x5101~0x5180, FN3.X1~128: 0x5201~0x5280, FN4.X1~128: 0x5301~0x5380,, FN64.X1~128: 0x8F01~0x8F80
 Ex,
 FN1.XW1~8: 0x5001~0x5008, FN2.XW1~8: 0x5101~0x5108, FN3.XW1~8: 0x5201~0x5208, FN4.XW1~8: 0x5301~0x5308,, FN64.XW1~8: 0x8F01~0x8F08

(8) Hi5 controller's relay structure



(9) Hi5 controller's I/O data flow

In/Out Data Flow

Application layer reads DI from HRBasic, or writes value on D0. Device layer reads D0 output. DI/D0's device driver layer reads and writes from PLC, I/O monitoring, or Modbus. So there may be some differences between the two according to the properties (logic/pulse/delay)



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**Hi5 Controller's
MODBUS
setting**



2. Hi5 Controller's MODBUS setting

Modbus

2.1. Serial port usage setting

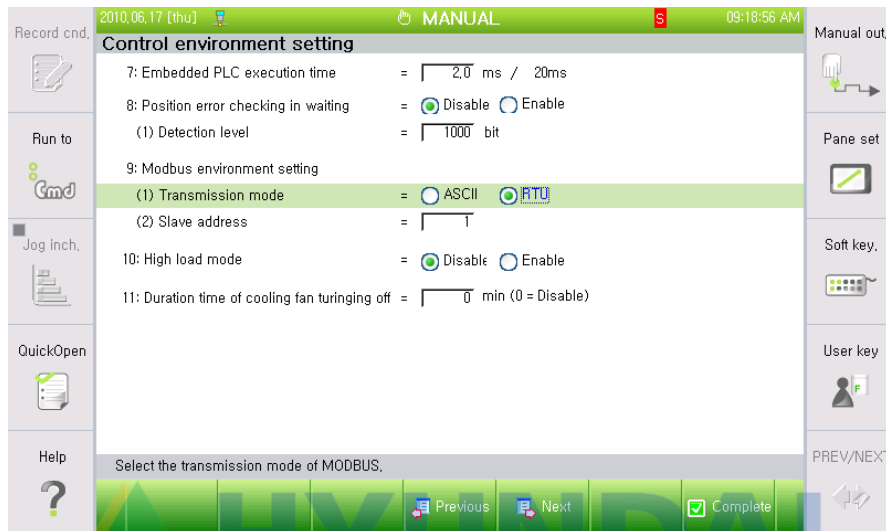
- (1) Setting Serial port to MODBUS can be done from 『[F2]: System』 → 『2: Control Parameter』 → 『3: Serial Port』 → 『1: Serial Port #1』 or 『2: Serial Port #2』 as below.



- (2) If serial port #1 and #2 are set to MODBUS, MODBUS slave module only refers to serial #1

2.2. MODBUS environment setting

MODBUS's detailed setting can be done from 『[F2]: System』 → 『2: Control Parameter』 → 『1: Control environment setting』 → 『9: Modbus environment setting』 as below.







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