HARDWARE MANUAL

HCA5 SERIES PROGRAMMABLE CONTROLLER

Foreword

• This manual contains text, diagrams and explanations which will guide the reader in the correct installation and operation of the HCA5 and should be read and understood before attempting to install or use the unit.
• If in doubt at any stage during the installation of the HCA5 always consult a professional electrical engineer who is qualified and trained to the local and national standards. If in doubt about the operation or use of the HCA5 please consult HCFA Electric distributor.
• This manual is subject to change without notice.

Notes on the symbols used in this manual
At various times throughout this manual certain symbols will be used to highlight points of information which are intended to ensure the user's personal safety and protect the integrity of the equipment. Whenever any of the following symbols are encountered, its associated note must be read and understood. Each of the symbols used will now be listed with a brief description of its meaning.

Hardware Warnings

 1) Indicates that the identified dangerWILLcause physical and property damage.

 2) Indicates that the identified danger could POSSIBLY cause physical and property damage.

 3) Indicates a point of further interest or further explanation.

Software Warnings

 4) Indicates special care must be taken when using this element of software.

 5) Indicates a special point of which the user of the associate software element should be aware.

 6) Indicates a point of interest or further explanation.

1. Introduction

This manual covers the hardware installation instructions for the following programmable logic controller (PLC) product ranges;

-HCA5 base and extension units

-HCA5 extension and special function blocks

Table 1.1: base unit

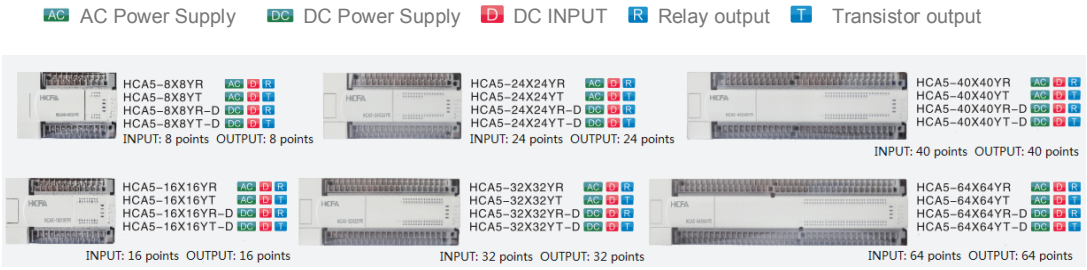


Table 1.2: Powered extension units

■Input Expansion	■Output Expansion	■Special Expansion Block/Analog Unit		■Input & output Expansion Block	■Positioning Control Block	■Analogue Block
TX2N-8EX TX2N-16EX	TX2N-8EYR TX2N-8EYT TX2N-16EYR TX2N-16EYT	A/D TX2N-2AD TX2N-4AD TX2N-8AD	D/A TX2N-2DA TX2N-4DA	TX2N-8ER TX2N-16ER	TX2N-1PG TX2N-4PG TX2N-10PG TX2N-1RM-SET TX2N-10GM TX2N-20GM	TX0N-3A TX2N-4AD-4DA TX2N-4AD-2DA TX2N-4AD-TC TX2N-4AD-PT TX2N-2LC TX2N-1HC

Figure 1.1: Dimensioned unit

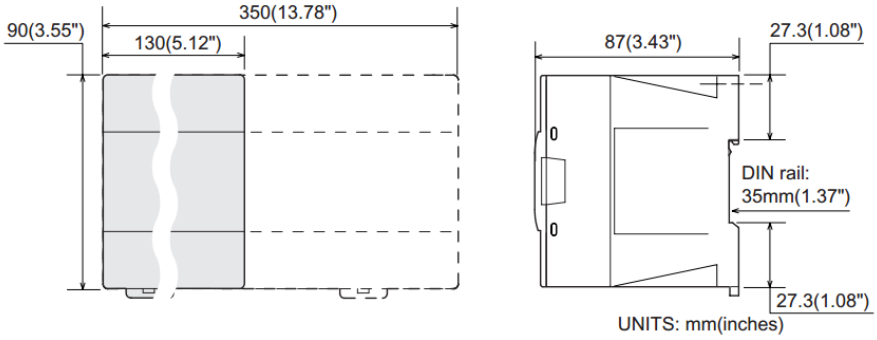
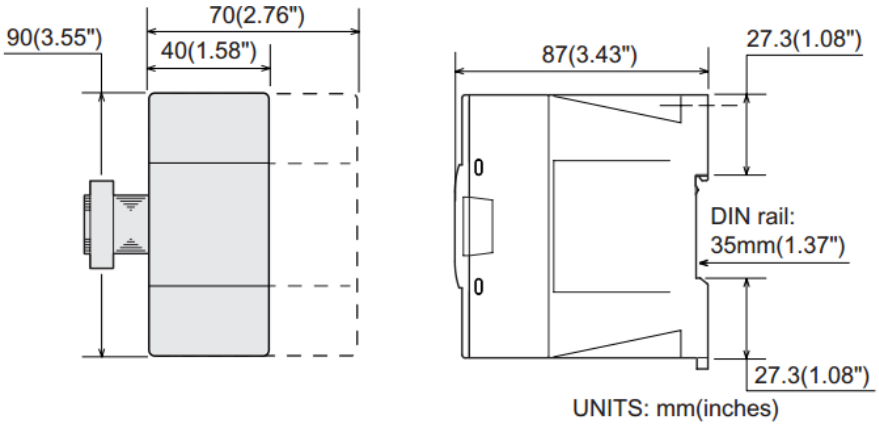


Figure 1.2: Extension block dimensions



1.1 Unit Accessories

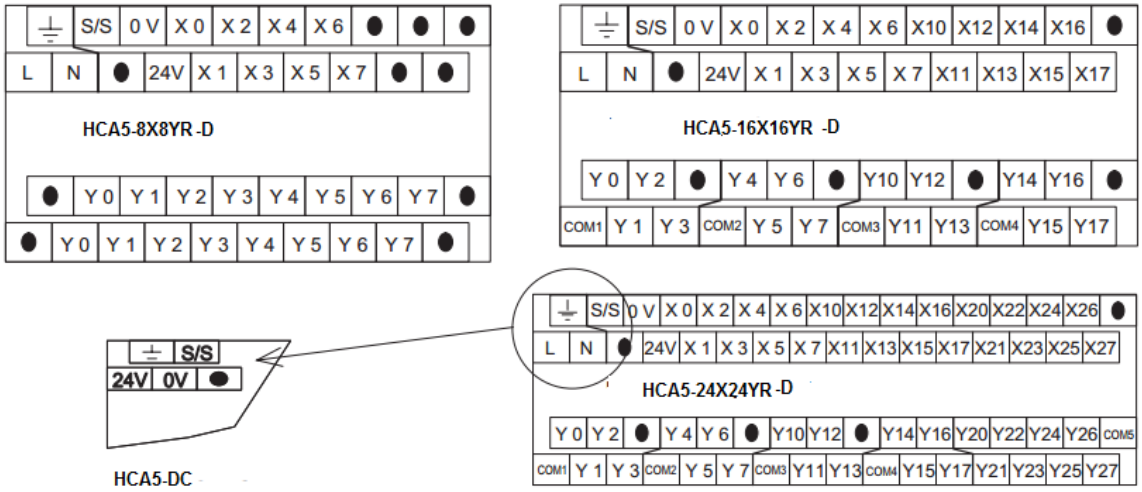
Each powered extension unit comes with: 1 I/O label kit and a 55mm (2.17 inch) extension cables.
Each extension and special function block comes with an I/O label kit.

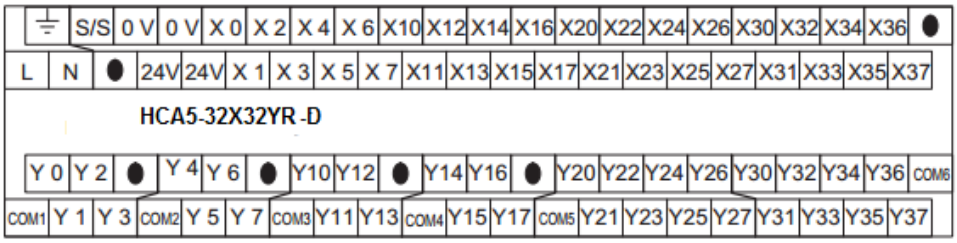
2. Terminal layouts

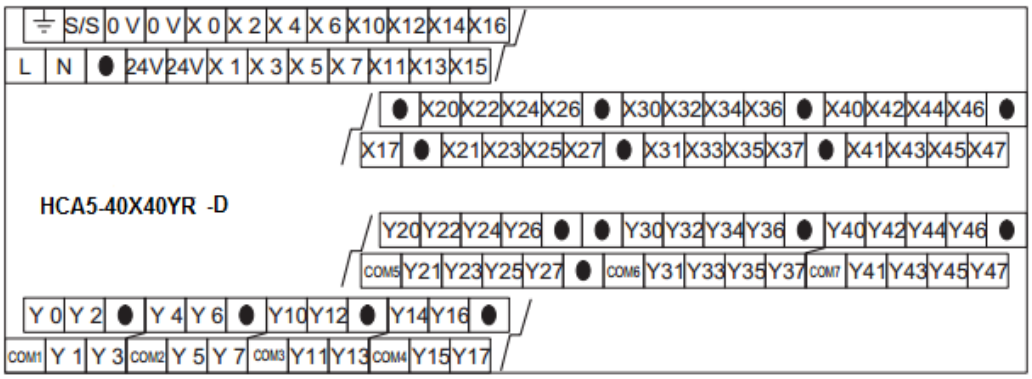
The following selection of terminal layouts are taken from the HCA5product range.
Note: All layouts are schematic only and are only intended to aid in the creation of wiring diagrams. Some units over 80
I/O do not conveniently fit on the page, hence the terminal rails have been split to suit.

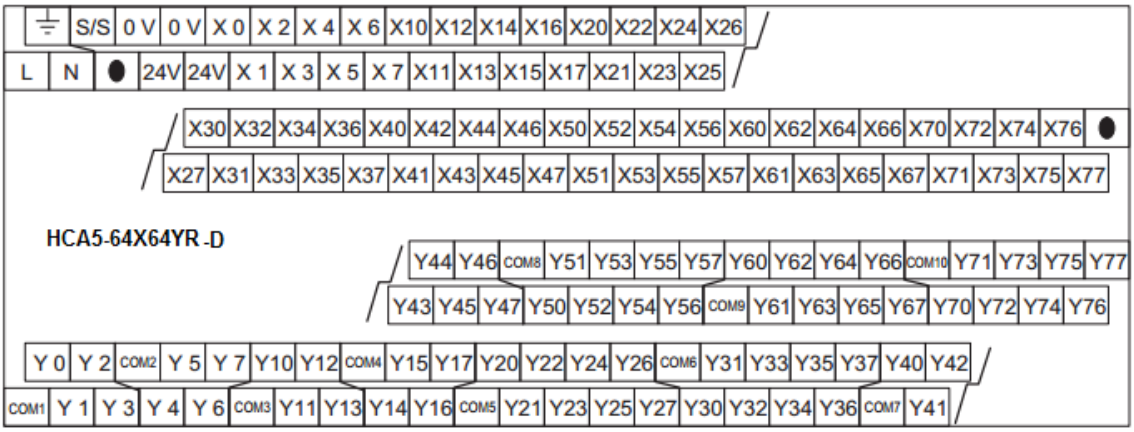
2.1 Relay output, 24V DC input MPU's

- Main Processing Unit (base units)



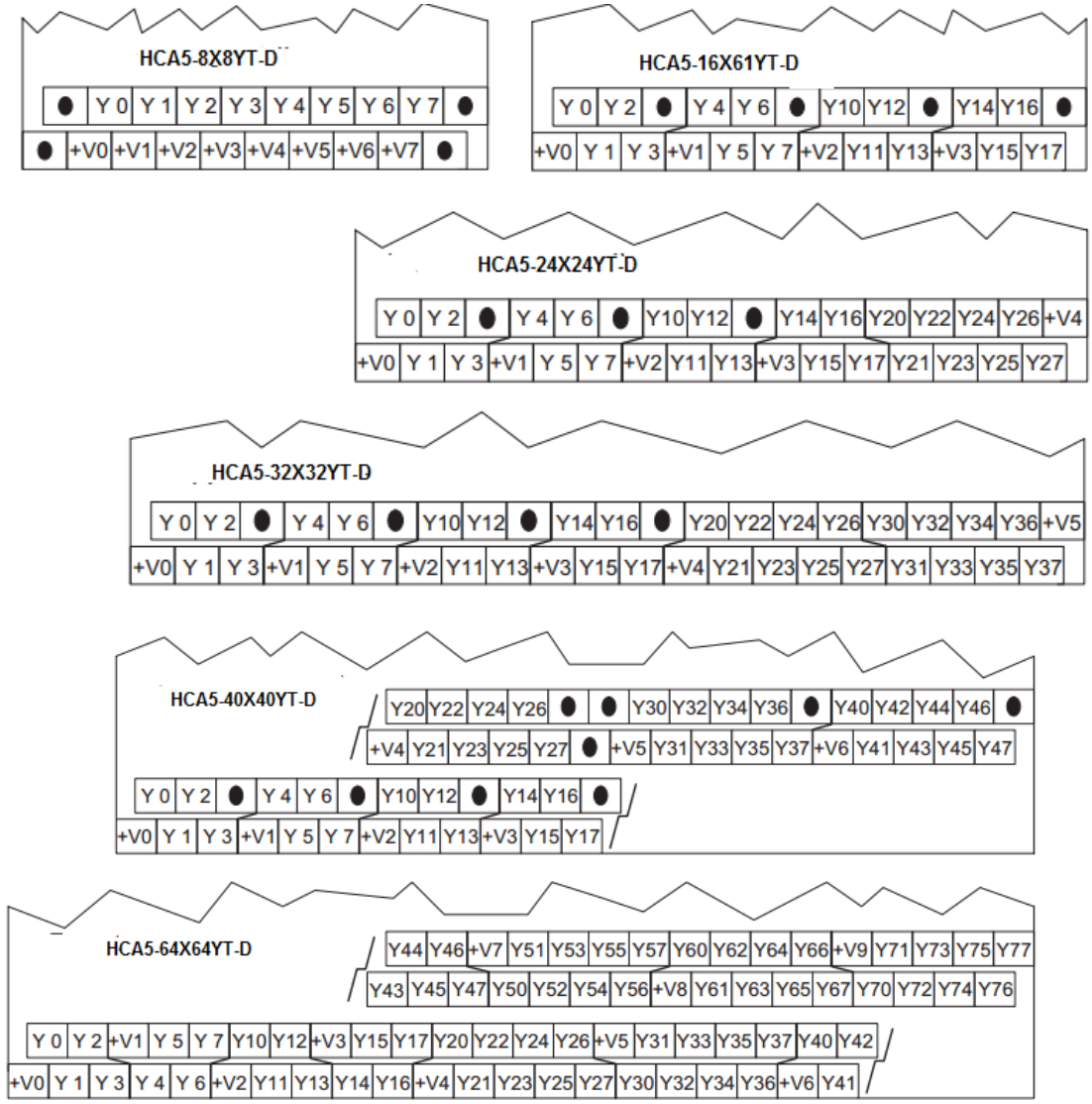






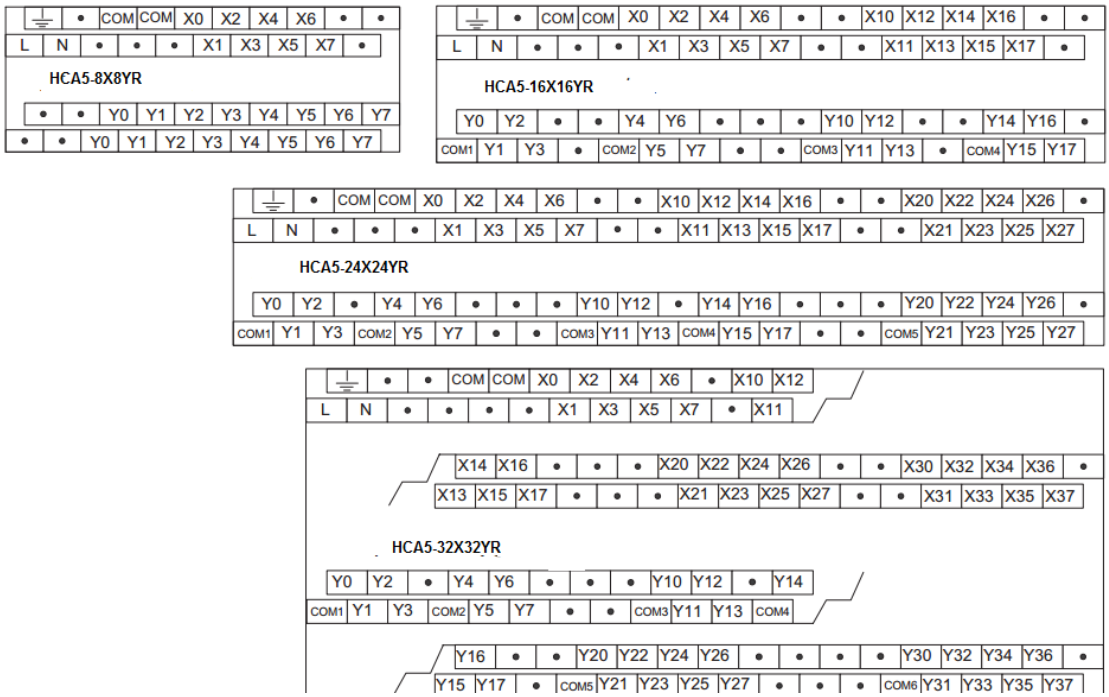
2.2 Transistor output, MPU's

- (base units)



2.3 AC 220V Input, MPUs

- (base units)

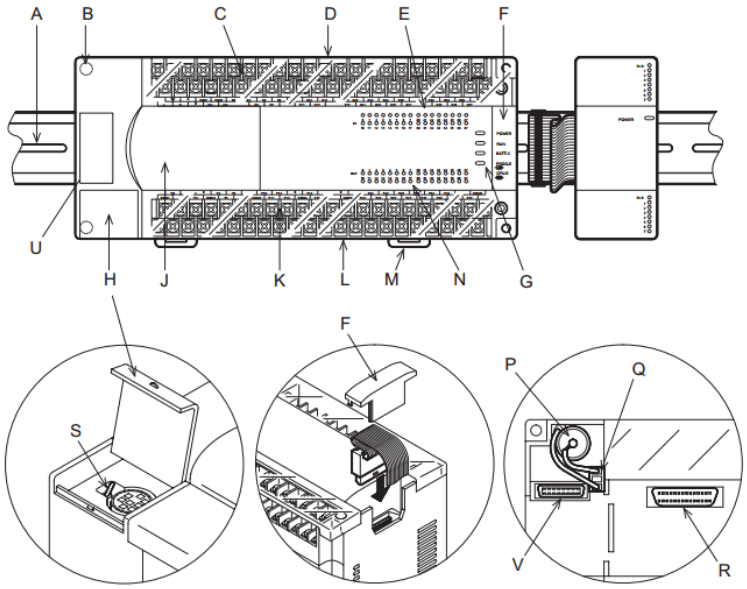


3. Installation

The installation of HCA5 products has been designed to be safe and easy. When the products associated with this manual are used as a system or individually, they must be installed in a suitable enclosure. The enclosure should be selected and installed in accordance to the local and national standards.

3.1 Product outline

Figure 3.1: Features of the HCA5 PLC



A DIN rail 35mm (1.37 inch) to DIN46277

B Alternative direct mounting holes
C Input terminals
D Input terminal cover
E Input indicators
F I/O Expansion bus cover
G Status indicators, POWER, RUN, BATT.V PROG.E CPU.E
H Programming port cover
J Top panel
K Output terminals
L Output terminal cover
M Din rail clip
N Output indicators
P Battery for battery backup
Q Connector for use with battery or super capacitor for power backed memory
R Memory cassette port - will accept any HC memory cassette
S Run/Stop switch
T Programming port
U Cutout for Extension board
V Extension board connector

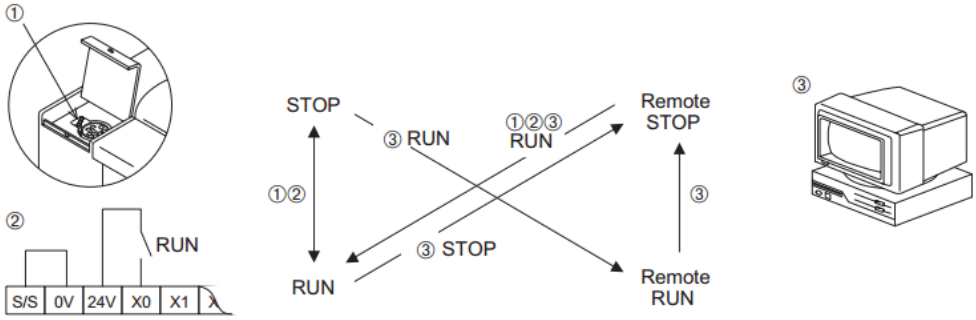
3.2 RUN/STOP Control

RUN or STOP of the HCA5can be controlled by:
①The RUN/STOP switch mounted next to the programming port.
②A standard input (X0 to X17; X0 to X7 for HCA5-8X8Y☆units) defined by the system parameters.
③Remotely from a personal computer or other programming peripheral.

Note: The HCA5 RUN/STOP switch ① works in parallel with the RUN-input terminal ② . Please refer to the table below.
During remote operation the HCA5RUN/STOP status is determined by the most recently operated control. E.g. If the RUN/STOP switch is in RUN and a remote STOP is made from a personal computer the RUN/STOP switch must be switched to STOP then back to RUN to switch the MPU back to RUN mode.

Table: RUN/STOP selection

① RUN/STOP SWITCH	② RUN INPUT TERMINAL	HCA5 MPU STATUS
4	4	RUN
4	8	RUN
8	8	STOP
8	4	RUN



3.3 General specifications

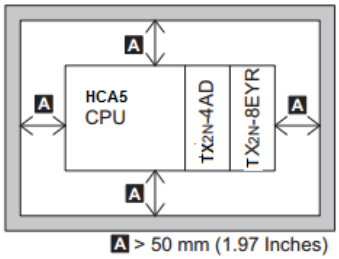
Items	SPEC
Operating temperature	0 - 55 °C, 32 - 131 F
Storage temperature	(-20) - 70 °C (-4) - 158 °F
Humidity No condensation	35 - 85% R.H.
Vibration resistance – Direct mounting 10 times in X, Y, Z (80mins/axis)	EN68-2-6:10 - 57 Hz, 0.075mm Half Amplitude.57-150Hz: 9.8m/s^2 Acceleration
Vibration resistance - Din rail mounting 10 times in X, Y, Z (80mins/axis)	EN68-2-6: 10 - 57 Hz, 0.035mm Half Amplitude.57-150Hz: 4.9m/s^2 Acceleration
Shock resistance 3 times in 3 directions	EN68-2-27: 11ms, 147m/s^2 Acceleration
Noise immunity tested by noise simulator	1000 Vpp, 1μs @ 30 -100Hz
Dielectric withstand voltage for AC power supply type tested between all terminals and ground	1500V AC >1min
Dielectric withstand voltage for DC power supply type tested between all terminals and ground	500V AC >1min
Insulation resistance tested between all points, terminals and ground	500V DC @ 5MΩ<
For use up to an altitude of…	<2000m
Installation category	II
Pollution degree	2
Grounding	100 ohms or less
Operating ambience to be free of corrosive gases.	

Dust should be minimal.

*1 Use HCA5series PLC with consideration for electric noise in an environmental that does not exceed conditions provided by EN50081-2 and EN61131-2.

3.4 PLC mounting arrangements

PLC mounting arrangements 3.4
To prevent a rise in temperature, mount the units to walls. Never mount them to the floor or ceiling of an enclosure.
Figure 3.2 Single row arrangement



Caution

- Units should not be installed in areas subject to the following conditions: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration.
- Take special care not to allow debris to fall inside the unit during installation e.g. cut wires, shavings etc. Once installation is complete remove the protective paper band to prevent overheating.
- During transportation avoid any impact as the PLC is a precision instrument.

It is necessary to check the operation of PLC after transportation, in case of any impact damage.

- During transportation avoid any impact to the battery (F2-40BL) as the PLC may be seriously damaged by liquid leakage etc. from the battery.
- When storing the PLC, conform to the environmental conditions specified by the general specification.

When the battery is left attached, it is necessary to avoid direct sunshine, high temperature, high humidity and water splash.

3.5 DIN rail mounting

Units can be ‘snap’ mounted on to 35mm (1.37 inch) DIN rail. To release the unit from a DIN rail mount; pull the spring loaded DIN clips away from the rail. Once the spring clips are clear, slide the unit up and off.

Never use DIN rail type mounting in areas of excessive vibration.

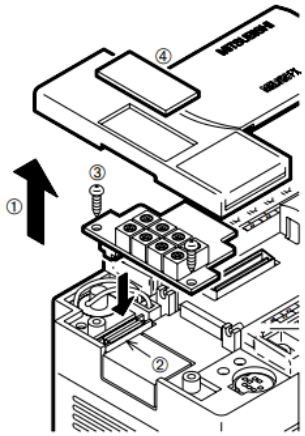
3.6 General notes

Always ensure that mounted units and blocks are kept as far as possible from high-voltage cables, high-voltage equipment and power equipment.

3.7 Extension Board Installation

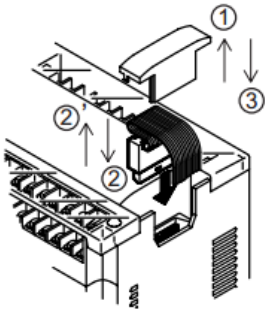
To install a special function extension board on the left side of the HCA5MPU:
①Remove the top cover of the HCA5.
②Fit the board to the connector and position over the screw holes correctly.
③Using the M3 self-tapping screws provided secure the board to the base unit. Torque 0.3 to 0.6 N·m (3 to 6 kgf.Cm)
④Remove the cut-out from the cover using cutters or pliers to allow access to the board.
Note: The TX2N-232-BD is provided with grounding brackets which should be fitted to the board before installation

3.8 Extension Units/Blocks Installation



Install/remove extension module as shown in the figure 3.5.
① Remove the extension bus cover.
② Install extension cable.
②' Remove extension cable.
③ Install the extension bus cover.

Caution
Cut off all phases of power source before installing/removing the extension unit/block.
Figure 3.5: Extension Unit/Block Installation



4. Wiring techniques

The wiring of HCA5products has been designed to be safe and easy. If during the installation of these product or associated products concern is felt, please contact a professional electrician who is trained to the local and national standards applicable to the installation site.

4.1 Wiring cautions

• Do not run input signals in the same multicore cable as output signals or allow them to share the same wire.
• Do not lay I/O signal cables next to power cables or allow them to share the same trunking duct. Low voltage cables should be reliably separated or insulated with regard to high voltage cabling.
• Where I/O signal lines are used over an extended distance consideration for voltage drop and noise interference should be made.
• Do not lay signal cables near high voltage power cabling or cabinet housing along the same trunking duct. Effects of noise or surge induction may occur. Keep signal cables of more than 100 mm (3.94") away from these power cables.
• Cut off all phases from the power source before installation or performing wiring work to avoid electric shock.
Incorrect operation can lead to serious damage to the product.
• Cut off all phases from the power source before installing/removing extension or communication cables to modules to avoid electric shock, incorrect operation or serious damage to the product.
• Replace the terminal cover provided, after installation or wiring work is completed, and before supplying power and operating the unit to avoid electric shock.
• After reading the manual's safety instruction, initiate the operation for making program changes while the PLC is in RUN mode, forcing ON/OFF, and switching RUN/STOP.
• The power supply of the extension units/blocks and the special function units/blocks should be started at the same time or earlier than the HCA5Series main unit.
• DO NOT use the “”terminal in PLC.
• When performing incorrect wiring or operation, serious damage will occur.

4.2 Termination at screw terminals

Terminal screws should be tightened to between 0.5 and 0.8 N·m. Terminal screws must be secured to prevent a loose connection thus avoiding a malfunction.
The terminal screws for the HCA5 Series PLC are M3.0.
. The crimp style terminal (see drawing) is suitable for use with these screws and should be fitted to the cable for wiring.

When installing 1 or 2 crimp terminals to a terminal, see explanation below. However, 3 crimp terminals or more should not be installed to a single terminal.

• Handle the crimp terminal of the following size when 1 wire is used per terminal. Refer to Figure 4.1, 4.2 and 4.3 for installation instructions.

• Handle the crimp terminal of the following size when 2 wires are used per terminal. Refer to Figure 4.4, 4.5 and 4.6 for installation instructions.

Figure 4.1: Crimp Terminals for M3.5 Screws

Figure 4.2: Crimp Terminals for M3. Screws

Figure 4.3: Installing 1 wire per a Terminal

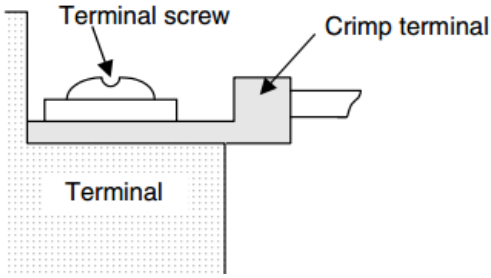


Figure 4.4: Crimp Terminals for M3.5 Screws

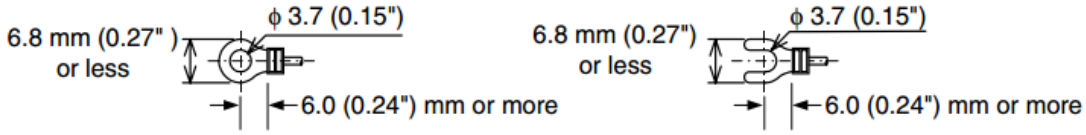


Figure 4.5: Crimp Terminals for M3 Screws

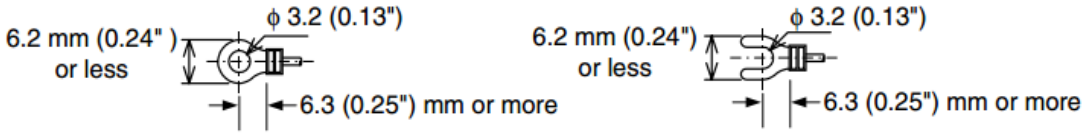
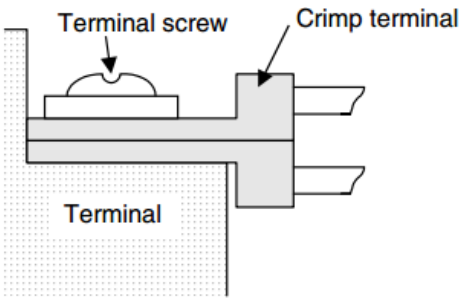


Figure 4.6: Installing 2 wires per a terminal



4.3 Power supply

When wiring AC supplies the 'Live'cable should be connected to the 'L' terminal and the 'Neutral' cable should be connected to the 'N' terminal.
When wiring DC supplies the 'positive'cable should be connected to the '+'terminal and the negative cable should be connected to the '-'terminal. On no account should the power supply terminals/cables be connected to any other terminal on the unit. All power cables must be at least $2mm^2$(AWG 14).

During emergencies all circuits to and from the unit or unit configuration should be turned off using a switch external to that configuration. (see items 3, 4 on figure 4.2). The active system should have a reliable method of fully isolating the high voltage supply lines during maintenance activities.
Install necessary power supply cut off precautions to the enclosure of the final system.
Attach a warning label (hazard symbol 417-IEC-5036) concerning electric shock to the enclosure.
When using an incorrect power source or performing incorrect operation, serious damage will occur regardless of the level of the voltage and frequency.
The "L"and "N"terminals are not reversible.
If the "L"and "N"terminals are reversed, the units/blocks may be seriously damaged.
The "24V"and "0V"terminals are not reversible.
If the "24V"and "0V"terminals are reversed, the units/blocks may be seriously damaged.

Table 4.1: Power requirements (all HCA5 type units)

	HCA5-*X*Y	**HCA5-*X*Y-D**
Power supply	100 - 240 V AC +10 % -15%, 50/60 Hz	24V DC +20%, -30%
Max. allowable momentary power failure period	10 msec. (10 msec. > PLC = RUN, 10 msec. < PLC = STOP)	PS1: 5ms*1 (D8008 = K-1) 5ms > PLC = RUN, 5ms < PLC = STOP
Fuse (size) rating	(Ø5 ×20 mm (0.2 ×0.79 inches)) HCA5-8X8Y, 16X16Y =3.15A (type 50CT-032H) HCA5-24X24Y, 32X32Y, 40X40Y, 62X62Y = 5A (type 50CT-050H)	

4.4 Earthing/Grounding

Use a cable at least $2mm^2$(AWG14) to ground equipment. Ground resistance must

be less than 100 Ω. Note that the ground cable must not be connected to the same ground as the power circuits.

4.5 Service power supply

If the system being installed uses the service supply from both the PLC and a powered extension block , then the 0V terminals should be linked.

- DO NOT however, link the 24V terminals.
- NEVER connect an external power supply to the PLC's 24V terminal.
- External DC supplies should not compromise the IEE Separated Extra Low Voltage (SELV) aspects of the HCA5 products.

5. Inputs

5.1 24V DC input specifications

	HCA5			**HCA5**	
	X0 - X7	**X10 ∞**		**X0 - X7**	**X10 ∞**
Input current	24V DC, 7mA	24V DC, 5mA	Type of Action	EN61131-2, Section 3.3.1.2 - Type 1	
OFF ON / ON OFF; input switching voltage (measured between input and S/S terminals) and current				>16.1V / <6.1V, >4.5mA / <1.5mA	>16.3V / <7.6V >3.5mA / <1.5mA
Response time				10msec	
Variable response time using REFF instruction, FNC 51				X000 - X017: 0 - 60 msec (HCA5-8X8Y : X000 - X007)	
Circuit isolation / Operation indication				Photocoupler / LED is lit	

5.1.1 Typical wiring

Figure 5.1: Source (positive input connection, negative S/S)

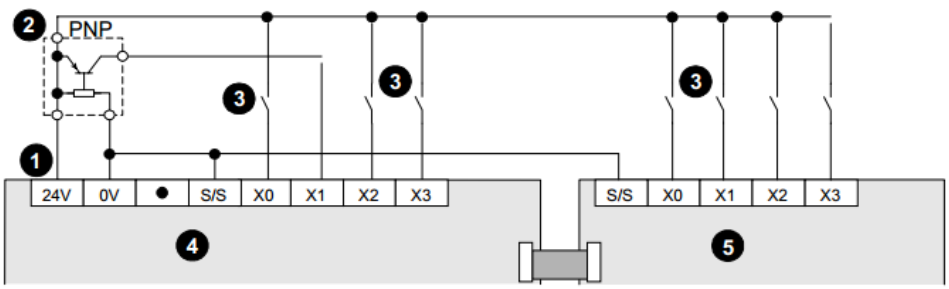


Figure 5.2: ENG ☞Sink (negative input connection, positive S/S)

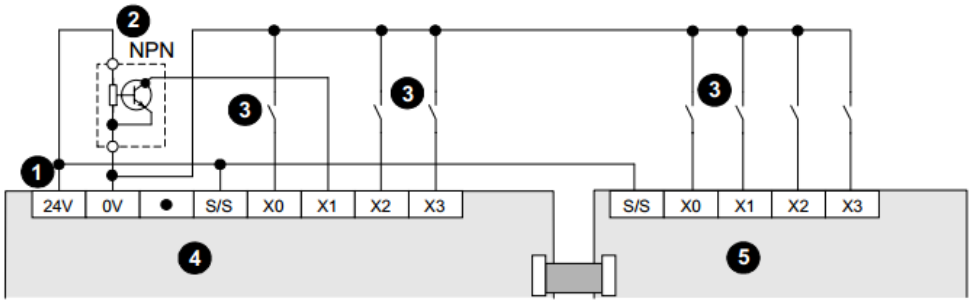
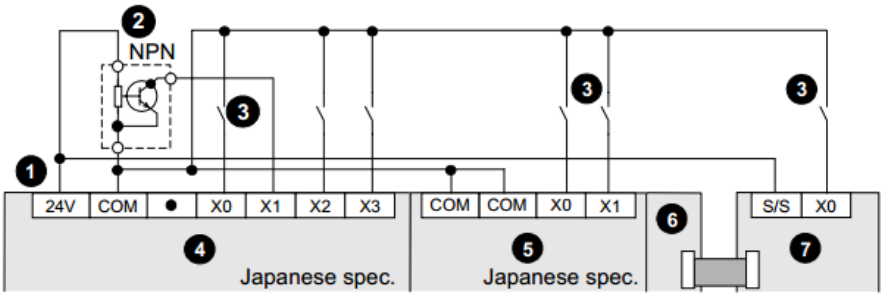


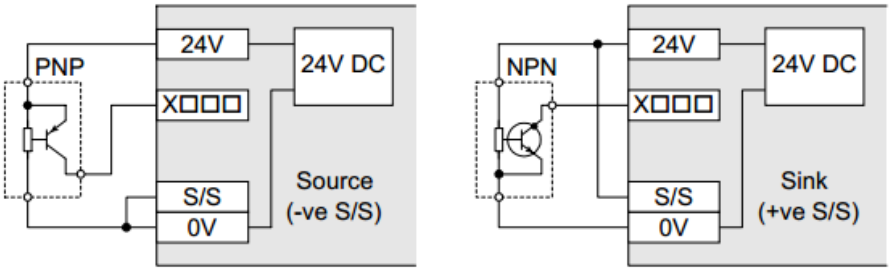
Figure 5.3: ENG ☞Sink (negative input connection, Japanese spec.)



5.1.2 Input circuit connection

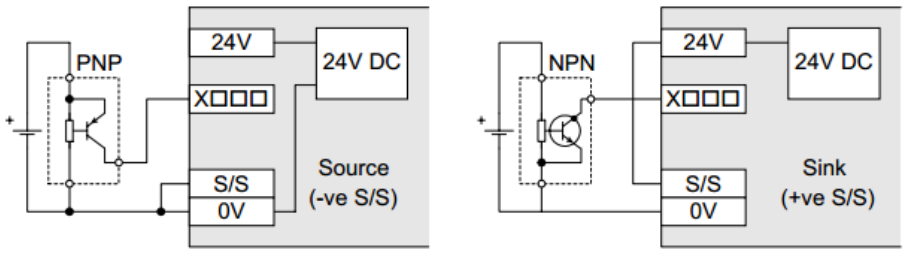
Internal supply

Example shown right, uses the PLC's internal service supply



External supply

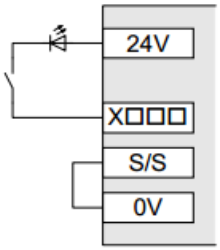
The example shown right, uses an external power supply to activate the inputs



5.1.3 Diodes and inputs connected in series

Diodes and inputs connected in series5.1.3

Vdrop accross the diode Max. 4V
No more than 2 LEDs should be connected in series.



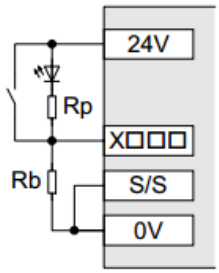
5.1.4 Resistors and inputs connected in parallel

Parallel resistance Rp: HCA5= 15kΩ. If resistance Rp is less than the stated value, then add Rb. See equation 1 for Rb calculation. Alternatively; Current leakage: HCA5= 1.5mA. If the current leakage is greater than the stated value, then add Rb. See equation 2 for Rb calculation

Figure 5.4: Parallel LED

$$\text{Epn 1: } Rb \leq \frac{4Rp}{15\text{-}Rp}$$

$$\text{Epn 2: } Rb \geq \frac{6}{I\text{-}1.5}$$



5.2 AC 110V Input, MPUs

Table: HCA5-*X*Y* input specification

	HCA5 (X0 → ∞)
Input voltage	85-132V AC 50/60Hz
Input impedence	21kΩ/ 50Hz 18 kΩ/ 60Hz
Input current	4.7mA 100V AC/50Hz 6.2mA 110V AC/60Hz
OFF→ON / ON →OFF; input switching current:	80V 3.8mA / 30V 1.7mA
Response time	25 - 30 msec
Circuit isolation / Operation indication	Photocoupler / LED is lit

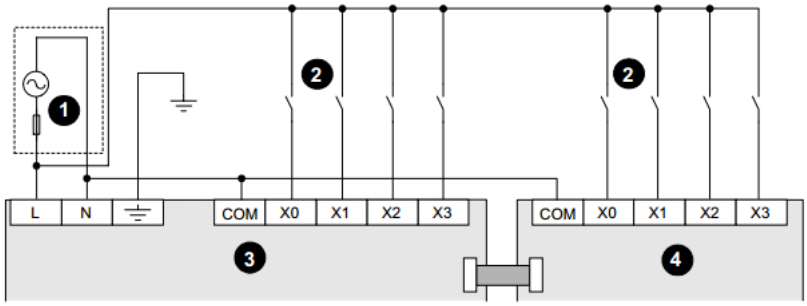
5.2.1 110V AC input specifications

Table: TX2N-8EX input specification

	HCA5 (X0 → ∞)
Input voltage	85-132V AC 50/60Hz
Input impedence	21kΩ/ 50Hz 18 kΩ/ 60Hz
Input current	4.7mA 100V AC/50Hz 6.2mA 110V AC/60Hz
OFF →ON / ON →OFF; input switching current	80V 3.8mA / 30V 1.7mA
Response time	25 msec
Circuit isolation / Operation indication	Photocoupler / LED is lit

5.2.2 Typical wiring

Figure 5.5: Typical wiring



5.2.3 Programming caution

When using 110V AC units, high speed counter and interrupt routines are not suitable for use due to the long 'ON/OFF' times. The following instructions are also not suitable.

6. Outputs

6.1 Relay output specification

Table 6.1: HCA5 relay specification

HCA5 (Y0 → ∞)			
Switched voltages (resistive load)	≤240V AC,30V DC	Rated current / N points (resistive load)	2A / 1 point. 8A / com.

Max. Inductive load (See table 6.2)	80 VA, 120 / 240 VAC	Max. lamp load (tungsten load)	100 W (1.17A / 85V AC 0.4A / 250VAC)
Minimum load	When supply voltage < 24V DC allow at least 2mA flow		
Response time (approx)	OFF →ON 10m sec ON →OFF 10m sec	Circuit isolation	by relay
Operation indication	LED is lit when coil is energized		
Internal Output protection	None		
Circuit protection device (Fuse)	Rated value according to the load		

6.1.1 Reliability tests

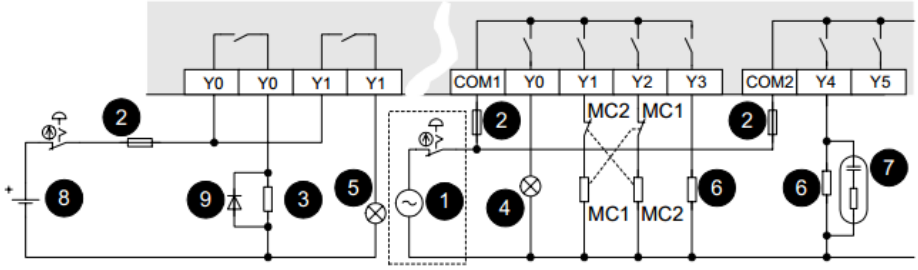
The test results in table 6.2 were gathered from a 1 sec ON/OFF test cycle. Please note that the over current induced by in-rush greatly reduces the relay contacts service life. The rated life for an inductive AC load such as a contactor or solenoid valve is 500,000 operations at 20VA.

Table 6.2:

	20 VA	**35 VA**	**80 VA**
Load capacity	0.2A/100V AC 0.1A/200V AC	0.35A/100V AC 0.15A/240V AC	0.8A/100V AC 0.33A/240V AC
Life of contact (cycles)	3,000,000	1,000,000	200,000
Example load (Mitsubishi contactor)	S-K10 S-K95	S-K100 S-K150	S-K180, S-K400

6.1.2 Relay output example

Figure 6.1: Typical wiring



①AC power supply
②Fuse
③Solenoid valve

④Incandesent lamp
⑤Neon lamp
⑥Contactor
⑦Noise suppressor 0.1 μF capacitor + 100 - 120 Ωresistor
⑧DC power supply
⑨Surge absorbing diode

6.2 Triac (SSR) output specifications

Table: HCA5 triac specification

HCA5 Y0 ∞			
Switched voltages (resistive load)	85 - 242 V AC	Rated current / N points (resistive load)	0.3A / 1 point. 0.8 A / com
Max. Inductive load	15 VA / 100V AC 36 VA / 240V AC	Max. lamp load (tungsten load)	30 W (0.35A / 85V AC 0.12A / 242V AC)
Minimum load	0.4 VA / 100V AC 2.3 VA / 240V AC	Open circuit current leakage	1mA / 100V AC 2.4mA / 240V AC
Response time (approx.)	OFF ON < 1m sec ON OFF < 10m sec	Circuit isolation	by photocoupler
Operation indication	LED is lit when photocoupler is driven.		
Internal Output protection	None		
Circuit protection device (Fuse)	Rated value according to the load		

6.2.1 In-rush currents

In-rush currents 6.2.1
These currents should be kept as low as possible. The root mean square (Irms) < 0.2A.
Reference Eqn 1 for (Irms)
Ir- In-rush current [A] Tr- In-rush time [sec]
Is- Switch current [A] Ts- Switch time [sec]
Tf- Operation time [sec]

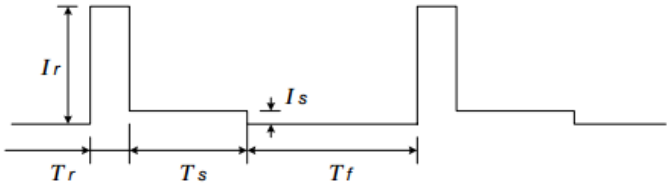
Eqn 1

$$I_{rms} = \sqrt{\frac{I_r^2 \times T_r + I_s^2 \times T_s}{T_r + T_s + T_f}}$$

Ex.

$$0.2A = \sqrt{\frac{4^2 \times 0.02 + 0.4^2 \times 0.7}{0.02 + 0.7 + 10}}$$

Figure 6.2: Current graph



6.2.2 Triac output example

Figure 6.3: Typical wiring

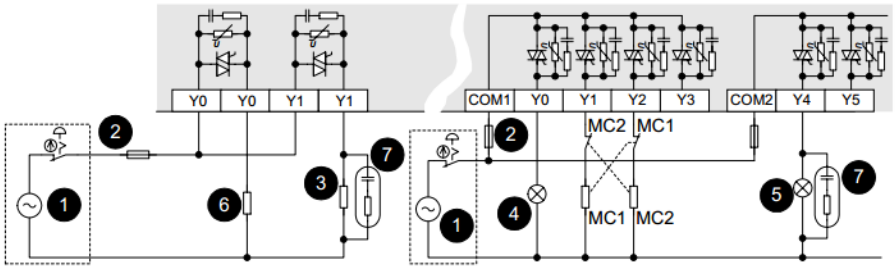


Table : Item check

①AC power supply

②Fuse

③Solenoid valve

④Incandesent lamp

⑤Neon lamp

⑥Contactor

⑦Noise suppressor

0.1 μF capacitor + 100 - 120 Ωresistor

6.3 Transistor output specification

Table: HCA5transistor specification

HCA5 Y0	∞

Switched voltage (resistive load)	5 - 30 V DC	Rated current / N points (resistive load)	0.5A / 1 point. 0.3 A / 1 point; Y000, Y001 0.8 A / com
Max. Inductive load	0.5A / 24V DC (12 W) 0.3A / 24V DC (7.2 W); Y0, Y1	Max. lamp load (tungsten load)	0.0625A/ 24V DC (1.5 W) 0.0375A/ 24V DC (0.9 W); Y000, Y001
Response time (approx) (see 6.3.1)	OFF ON < 0.2 msec (200mA / 24V DC) Y000, Y001; < 15μS (100mA / 5V DC) ON OFF < 0.2 msec*1 (200mA / 24V DC) Y000, Y001; < 30μS (100mA / 5V DC)		
Open circuit current leakage	0.1 mA / 30V DC	Circuit isolation	by photocoupler
Operation indication	LED is lit when photocoupler is driven		
Internal Output protection	None		
Circuit protection device (Fuse)	Rated value according to the load		

*1 Response time of the TX2N-8EYT-H is 0.4ms or less.

6.3.1 Response times

Response times 6.3.1

OFF times increase as the load current decreases. For improved response times use a ‘dummy’ resistor, see Figure 6.4. If a response time of 0.5 msec or better is required when using ‘light loads’ use a ‘dummy’ resistor and ensure the signal line has a current greater than 60mA/24V DC.

Figure 6.4: Dummy load

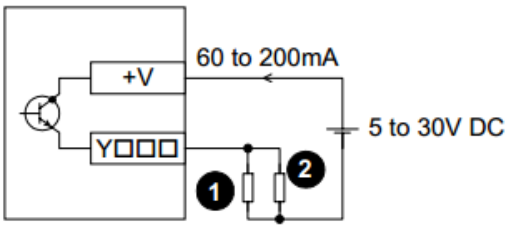


Table: Item check FRE

①Dummy load

②Load

6.3.2 Transistor output example

Figure 6.5: HCA5 (Source)

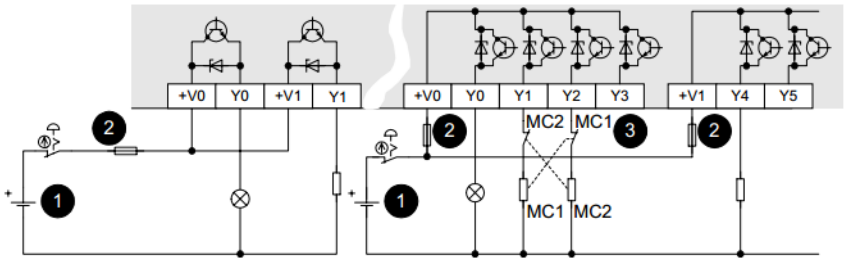


Table: Item check
①DC power supply
②Fuse
③External mechanical inter-lock
④Internal noise suppressor

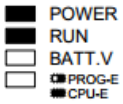
6.4 Applying safe loads

Ensure all loads are applied to the same side of each PLC output, see previous figures. Loads which should NEVER simultaneously operate (e.g. direction control of a motor), because of a safety critical situation, should not rely on the PLC's sequencing alone. Mechanical interlocks MUST be fitted to all safety critical circuits. (See preceding figure.)

7. Diagnostics

7.1 Preliminary checks

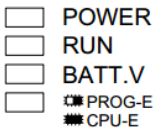
REF.	
POWER RUN BATT.V PROG-E CPU-E	Check power supply, ground and I/O cables are wired correctly. Check all terminal screws are tight.
POWER RUN BATT.V PROG-E CPU-E	Turn the power supply on. Check the power LED is lit. Down load a small test program into the PLC using a handheld programmer or MEDOC. Verify the program to ensure it has been written to

	the PLC correctly. Using the programming device forcibly turn ON/OFF each output. Check the output LEDS for operation
	Put the PLC into RUN. Check the RUN LED is lit. Check the previously down loaded program works correctly. Once all checks are complete take the PLC out of run and turn OFF the power supply.
	During this testing stage take extreme care not to touch any live or hazardous parts

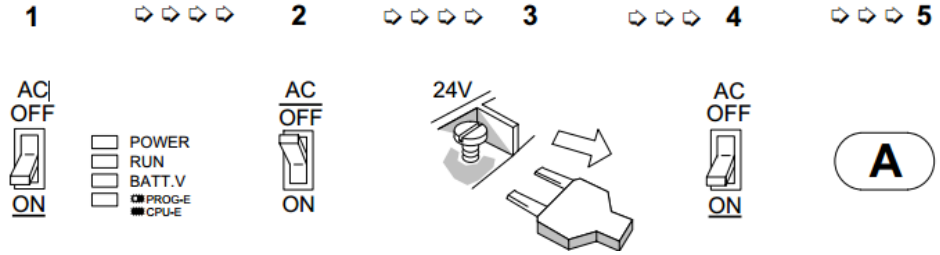
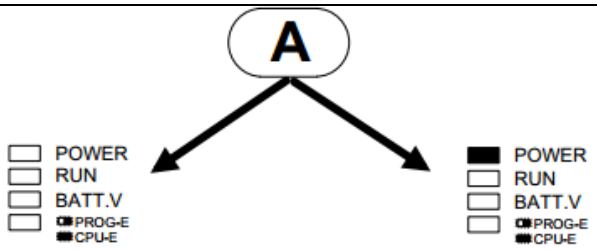
7.2 Basic diagnostics

The following diagnostic functions will help identify, common faults.

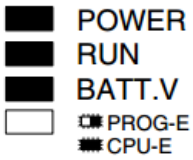
7.2.1 Power ON, PLC OFF



Power ON, PLC OFF

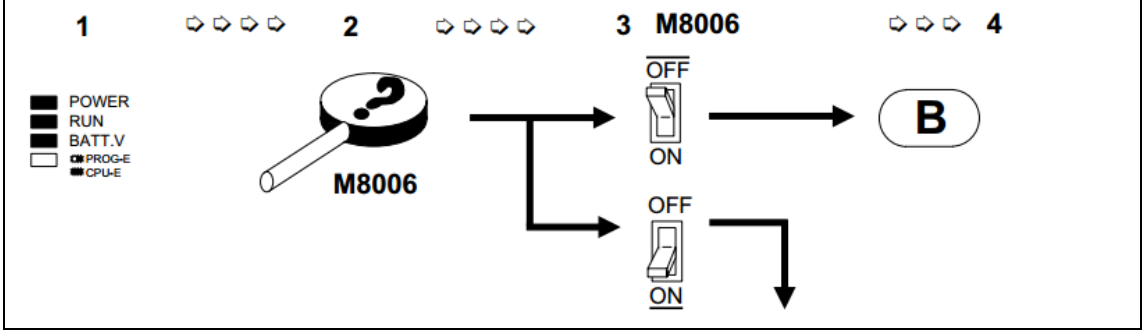
Fault	Remedy
Power ON, PLC OFF	Disconnect 24V DC terminal
	
	
Power LED remains OFF Possible fuse blown in the PLC. Contact a Mitsubishi service center for repair work	Power LED comes ON Too many loads connected to the 24V DC service supply. Provide additional supplies of 24V DC.

7.2.2 BATT.V LED ON

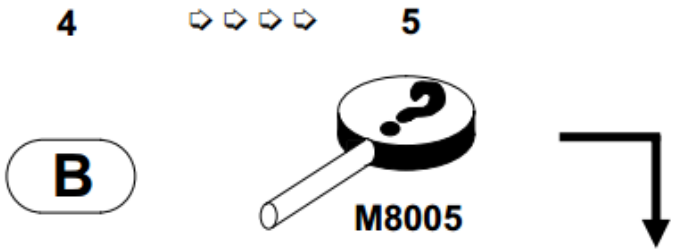


BATT.V LED ON

Fault	Remedy
BATT.V LED ON	Monitor M8006 with a programming tool.

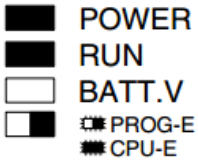


Possible results: If the current program and/or data is stored only in the PLCs RAM, copy and store this immediately.
Proceed to replace the PLCs battery.

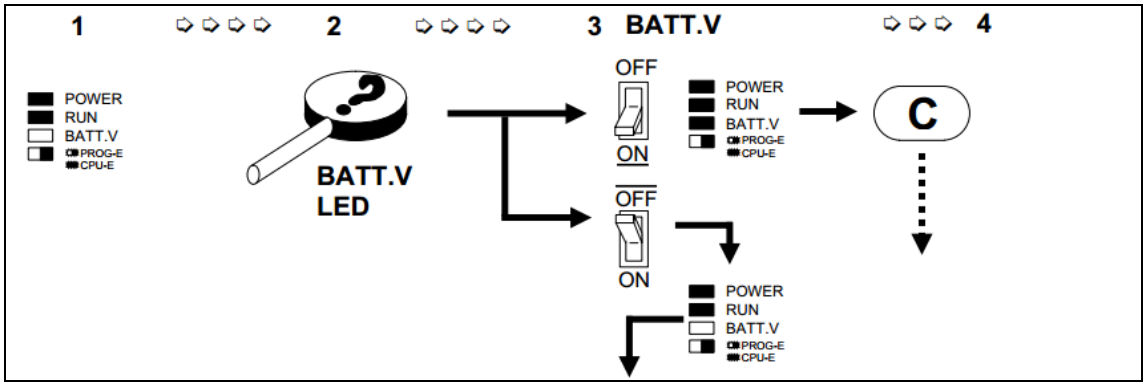


Monitor D8005. This is the current battery voltage (in 0.1V units).
Contact a Mitsubishi service center for further consideration of the problem.

7.2.3 PROG.E LED flashes



Fault	Remedy
PROG.E LED flashes	Check BATT.V LED.



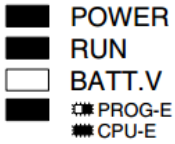
Possible results

Is the BATT.V OK?

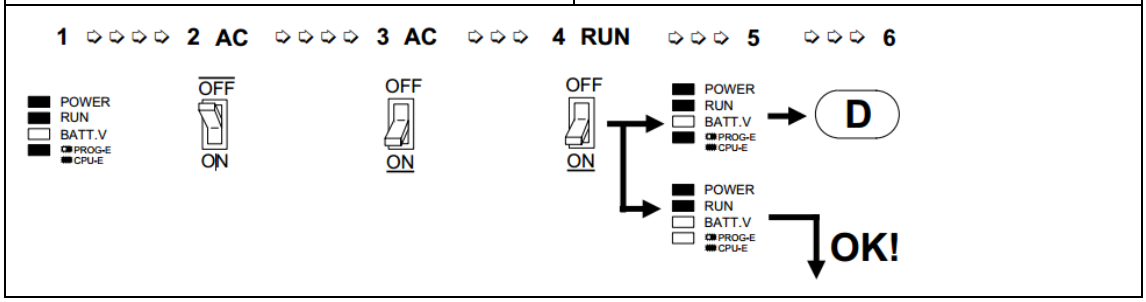
Work through BATT.V diagnostic.

If the BATT.V LED is cured yet the PROG.E LED still flashes check for a programming problem

7.2.4 CPU.E LED ON



Fault	Remedy
CPU.E LED ON	Reset PLC. Power OFF, ON and trigger RUN input.

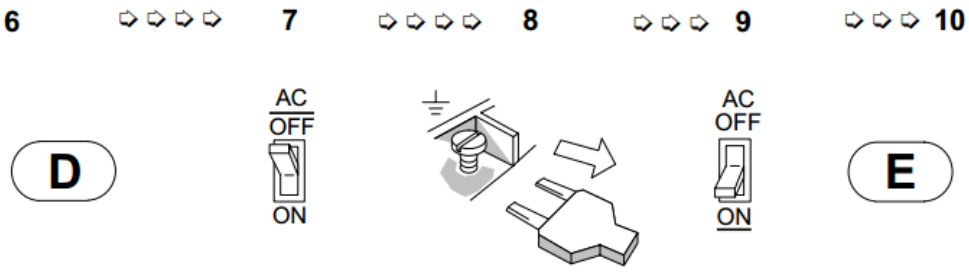


Possible results

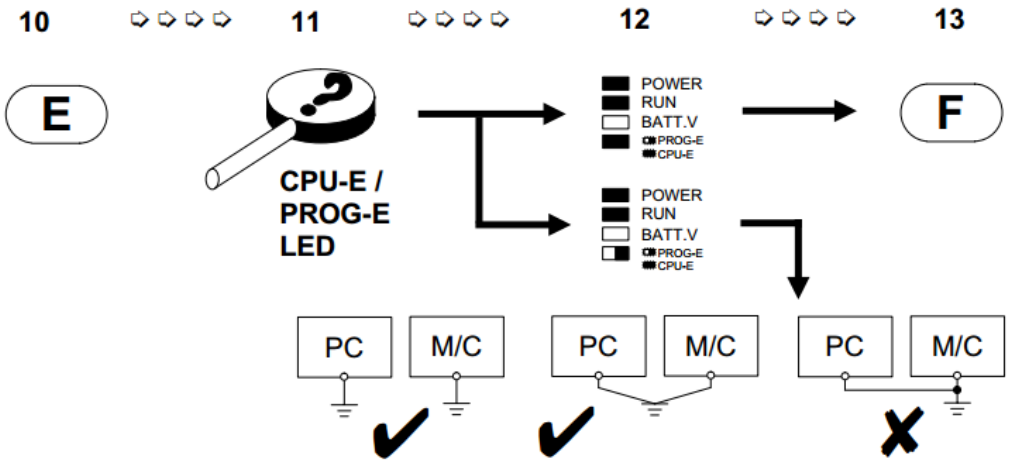
Has the memory cassette been installed or removed while the units has still been powered

Remedy

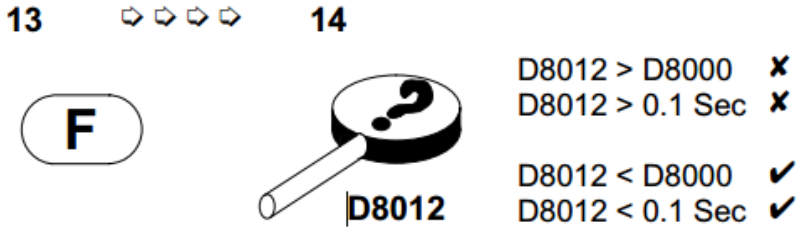
Disconnect earth/ground terminal



Possible results
Check CPU-E / PROG-E LED



PROG.E LED is flashing.
Check for programming error. Ensure the earth/ground cable is correctly re-wired Remedy
Possible program/scan time error. Check D8012 for program scan time, (units 0.1msec must be less than 0.1 sec, i.e data value < 1000)



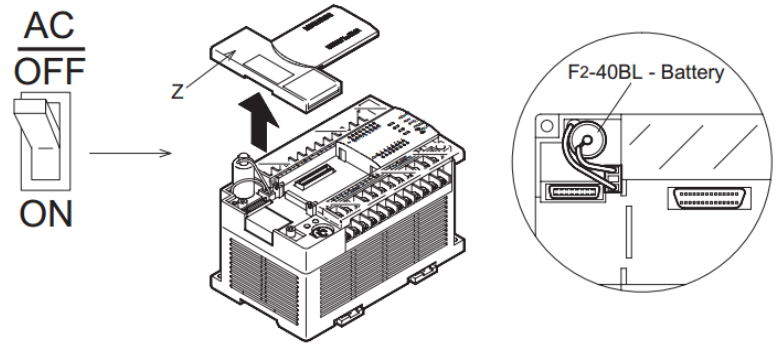
Possible results
D8012 > D8000

7.3 Common errors

- Corroded contact points at some point in an I/O line.
- An I/O device has been used outside its specified operating range.
- An input signal occurs in a shorter time period than that taken by one program scan.
- 24V DC power supply is overloaded.

7.4 Replacing the battery

Replacing the battery 7.4
Turn OFF PLC's power supply. Remove top cover (Z) from the PLC. Remove battery from holder - disconnect and replace.
(This should be carried out in 20s if the current data held in the PLC's RAM is not to be lost). Refit battery and cover



7.5 Maintenance

- Battery has a 5 year life (3 years when used with RAM-8).
- Check interior temperature of the panel.
- Check panel air filters if fitted.
- Check for loosening of terminals or mounting facilities (due to vibration)

7.6 Error flags ON indicates error.

Table 7.2: Error flags (M8004 - M8039)

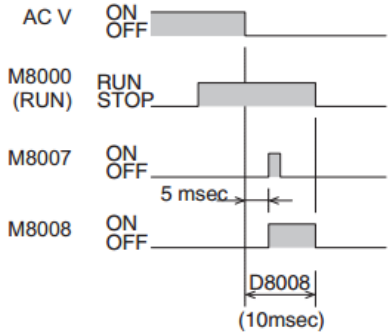
REF.	
M8004 (ref. D8004)	Error occurrence (ON when M8060-7 are ON)
M8005	Battery voltage abnormally low
M8006 (ref. D8005/6)	Latched low battery voltage flag
M8007 (ref. D8007/8	Momentary power failure
M8008 (ref. D8008)	Power failure (see Figure)
M8009 (ref. D8009)	24V DC OFF
M8030	Battery LED OFF Battery voltage low
M8035	Forced RUN mode
M8036	Forced RUN signal
M8037	Forced STOP signal
M8039 (ref. D8039)	Constant scan mode

Table 7.3: Error flags (M8060 - M8069)

REF.	
M8060 (ref. D8060)	I/O configuration error
M8061 (ref. D8061	PLC hardware error
M8062 (ref. D8062)	PC/programming device communication error
M8063 (ref. D8063)	Parallel link error
M8064 (ref. D8064)	Parameter error

M8065 (ref. D8065, D8069)	Syntax error
M8066 (ref. D8066,D8069)	Program (circuit) error
M8067 (ref. D8067,D8069)	Program execution error
M8068 (ref. D8068)	Execution error latch
M8069 (ref. D8069)	I/O bus check

Figure 7.1: Power down and its associated flags



7.7 Error registers

Table 7.4: Error registers (D8000 - D8009)

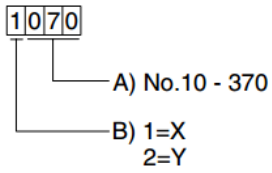
REF.	
D8000 (default 100msec)	Watchdog timer
D8001	PLC version
D8002	Memory capacity
D8003	Memory type
D8004	Error flag number
D8005	Battery voltage
D8006 (default 3.0V)	Low battery detection level
D8007	Number of momentary power failures - reset on full power OFF
D8008 (default 10msec)	Power failure detection period
D8009	Lowest device affected by 24V DC power failure

Table 7.5: Error registers (D8060 - D8069)

REF.	
D8060	Reports location of I/O configuration error (see Figure 7.2)
D8061	Error code for PLC hardware error
D8062	Error code number for programmer communications fault
D8063	Error code for parallel link fault
D8064	Parameter error code
D8065	Syntax error code
D8066	Program (circuit) error code
D8067	Program execution error code
D8068	Latched step number of execution error

D8069	Step number of errors associated with error flags M8065 - M8067

Figure 7.2: I/O configuration error



ITEM	
A	number
B	type

7.8 Error codes

Table 7.7: Error codes(D8061 - D8062)

REF.	
D8061	Check cable connections
0000	No error
6101	RAM error
6102	Operation circuit error
6103	I/O bus error (M8069 = ON)
D8062	Check the programmer / PC connections
0000	No error
6201	Parity/ overrun/ framing error
6202	Character error
6203	Data sum check error
6204	Data format error
6205	Command error
D8063	Check both power and communications connections
0000	No error
6301	Parity/ overrun/ framing error
6302	Character error
6303	Data sum check error
6304	Data format error
6305	Command error
6306	Watchdog timer error

7.9 Instruction list

Table 7.8: Numerically sorted

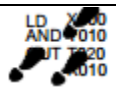
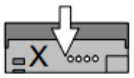
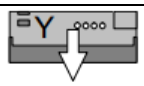
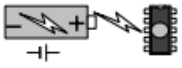
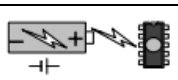
		0	1	2	3	4	5	6	7	8	9
000	PROGRAM FLOW	CJ	CALL	SRET	IRET	EI	DI	FEND	WDT	FOR	NEXT
010	TRANSFERS, COMP	CMP	ZCP	MOV	SMOV	CML	BMOV	FMOV	XCH	BCD	BIN
020	+, −, ×, ÷, LOGICS	ADD	SUB	MUL	DIV	INC	DEC	WAND	WOR	WXOR	NEG
030	ROTATION, SHIFT	ROR	ROL	RCR	RCL	SFTR	SFTL	WSFR	WSFL	SFWR	SFRD
040	DATA OPERATION 1	ZRST	DECO	ENCO	SUM	BON	MEAN	ANS	ANR	SQR	FLT
050	HIGH-SPEED	REF	REFF	MTR	HSCS	HSCR	HSZ	SPD	PLSY	PWM	PLSR
060	HANDY INSTR. 1	IST	SER	ABSD	INCD	TTMR	STMR	ALT	RAMP	ROTC	SORT
070	FX I/O DEVICES	TKY	HKY	DSW	SEGD	SEGL	ARWS	ASC	PR	FROM	TO
080	FX SER DEVICES	RS	PRUN	ASCI	HEX	CCD	VRRD	VRSC	-	PID	-
110	FLOATING POINT 1	ECMP	EZCP	-	-	-	-	-	-	EBCD	EBIN
120	FLOATING POINT 2	EADD	ESUB	EMUL	EDIV	-	-	-	ESQR	-	INT
130	FLOATING POINT 3	SIN	COS	TAN	-	-	-	-	-	-	-
140	DATA OPERATION 2	-	-	-	-	-	-	-	SWAP	-	-
150	POSITIONING	-	-	-	-	-	ABS	-	-	-	-
160	REAL TIME CLOCK	TCMP	TZCP	TADD	TSUB	-	-	TRD	TWR	-	Hour
170	GREY CODES	GRY	GBIN	-	-	-	-	RD3A	WR3A	-	-
180	ADDTIONAL FUNC.	EXTR	-	-	-	-	-	-	-	-	-
220	IN-LINE COMPARE	-	-	-	-	LD=	LD>	LD<	-	LD≠	LD≤
230		LD≥	-	AND=	AND>	AND<	-	AND≠	AND≤	AND≥	-
240		OR=	OR>	OR<	-	OR≠	OR≤	OR≥	-	-	-

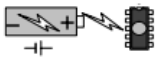
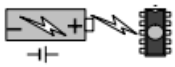
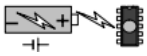
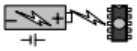
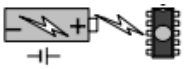
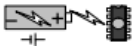
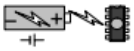
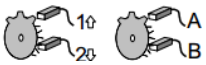
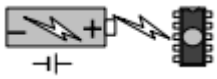
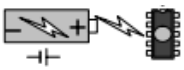
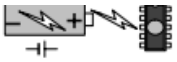
Table 7.9: Alphabetically sorted

	Symbol	FNC No.	D	P
A	ABS	155		
	ABSD	062		
	ADD	020		
	ALT	066		
	AND	232 - 234, 236 - 238		
	ANR	047		
	ANS	046		
	ARWS	075		
	ASC	076		
	ASCI	082		
B	BCD	018		
	BIN	019		
	BMOV	015		
	BON	044		
C	CALL	001		
	CCD	084		
	CJ	000		
	CML	014		
	CMP	010		
	COS	131		
D	DEC	025		
	DECO	041		
	DI	005		
	DIV	023		
	DSW	072		
E	EADD	120		
	EBCD	118		
	EBIN	119		
	ECMP	110		
	EDIV	123		
	EI	004		
	EMUL	122		
	ENCO	042		
	ESQR	127		
	ESUB	121		
	EXTR	180		
	EZCP	111		
F	FEND	006		
	FLT	049		
	FMOV	016		
	FOR	008		
	FROM	078		

	Symbol	FNC No.	D	P
G	GBIN	171		
	GRY	170		
H	HEX	083		
	Hour	169		
	HKY	071		
	HSCR	054		
	HSCS	053		
	HSZ	055		
I	INC	024		
	INCD	063		
	INT	129		
	IRET	003		
	IST	060		
L	LD	224 - 226, 228 - 230		
M	MEAN	045		
	MOV	012		
	MTR	052		
	MUL	022		
N	NEG	029		
	NEXT	009		
O	OR	240 - 242, 244 - 246		
P	PID	088		
	PLSR	059		
	PLSY	057		
	PR	077		
	PRUN	081		
	PWM	058		
R	RAMP	067		
	RCL	033		
	RCR	032		
	RD3A	176		
	REF	050		
	REFF	051		
	ROL	031		
	ROR	030		
	ROTC	068		
	RS	080		

	Symbol	FNC No.	D	P
S	SEGD	073		
	SEGL	074		
	SER	061		
	SFRD	039		
	SFTL	035		
	SFTR	034		
	SFWR	038		
	SIN	130		
	SMOV	013		
	SORT	069		
	SPD	056		
	SQR	048		
	SRET	002		
	STMR	065		
	SUB	021		
	SUM	043		
	SWAP	147		
T	TADD	162		
	TAN	132		
	TCMP	160		
	TKY	070		
	TO	079		
	TRD	166		
	TSUB	163		
	TTMR	064		
	TWR	167		
	TZCP	161		
V	VRRD	085		
	VRSC	086		
W	WAND	026		
	WDT	007		
	WOR	027		
	WR3A	177		
	WSFL	037		
	WSFR	036		
	WXOR	028		
X	XCH	017		
Z	ZCP	011		
	ZRST	040		

		HCA5	
		8000 steps, HC-RAM-8 = 8K - 16K steps HC -EPROM-8 = 8K -16K steps HC -EEPROM-16 = 4K - 16K steps	
		X0 - 327 (256 pnts)	(X+Y) ⩽ 256 pnts Max.
		Y0 - 327 (256 pnts)	
 (3072		M0 - M499 (500 pnts)	 by Parameters
		M500 - M1023 (524 pnts)	

pnts, +256 pnts)		M1024 - M3071(2048 pnts)	
		M8000 - M8255 (256 pnts)	
 (1000 pnts)		S0 - S499 (500 pnts)	 by Parameters
		S500 - S999 (500 pnts) (S900 - S999 ANS FNC46)	
 (256 pnts)	100msec	T0 - T199 (200 pnts)	
	10msec	T200 - T245 (46 pnts)	
	1msec 	T246 - T249 (4 pnts)	
	100msec	T250 - T255 (6 pnts)	
 (256 pnts)	16 bit	C0 - C99 (100 pnts)	 by Parameters
	16 bit 	C100 - C199 (100 pnts)	
	32 bit	C200 - C219 (20 pnts)	 by Parameters
	32 bit 	C200 - C234 (15 pnts)	
		C235 - C245	
		C246 - C250	
		C251 - C255	
 (8000 pnts, +256 pnts)		D0 - D199 (200 pnts)	 by Parameters
		D200 - D511 (312 pnts)	
		D512 - D7999 (7488 pnts)	 (D100-D7000 by parameter, 1blk=500stps)
		D8000 - D8255 (256 pnts)	
		V0 - V7, Z0 - Z7 (16 pnts)	
	CALL (FNC 01)	P0 - P127 (128 pnts)	
	EI (FNC 04)	I00 - I50 , I6 -I8 , I010 - I060 (6, 3, 6 pnts)	
	MC / MCR	N0 - N7 (8 pnts)	
Numbers		16 bit	32 bit
	K	-32,768 to 32,767	-2,147,483,648 to 2,147,483,647
	H	0 to FFFFH	0 to FFFFFFFFH
	Float	-	0 ±1.175 x 10^{-38} to ±3.403 x 10^{38}