

## User Manual for Changfang PLC

- Support connecting to HMI compatible with Mitsubishi PLC
- Support connecting to Console compatible with Mitsubishi PLC
- Support connecting to one step motor
- Support computer monitoring
- Very hard security of firmware
- Support 32-bit instruction
- Direct download with no need of conversion

All our PLC products are compatible with Mitsubishi Fx2N series PLC. Downloading can be done directly with no need of conversion.

The computer software for our PLC products is compatible with Mitsubishi's GX Developer, the versions from GX V8.31 to V8.86 are tested, other versions are not guaranteed.

Currently the GX Developer does not run perfectly under Windows Vista and Windows 7, so it is strongly recommended to use GX Developer under Windows 2000 or Windows XP.

This user manual is applicable to all our 2N series PLC products including its ladder diagram editor and PLC learning device, since their functions, usage, instruction set, and soft component resources are the same, only the power supply and terminal numbers are different.

All our PLC products fully support 32-bit instruction set, e.g. the instructions with prefix D, such as DMOV, etc.

### 1. Features

High speed pulse output  
(for Y0 only, ideal to control step motor. A 1K/1W resistor is required in serial to connect a 24V step motor)

High speed pulse input  
(for connecting encoder)

Write  
code/parameter/comment directly  
without conversion

Read code/parameter/comment

Parity check for code/parameter/comment

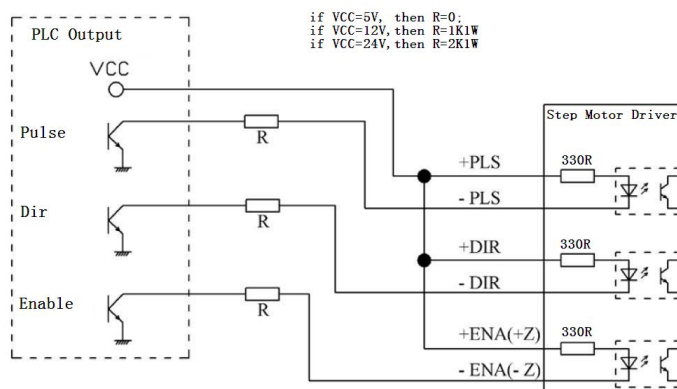
Computer monitor (for debug purpose)

Multiple soft components

Soft components login

Soft components testing

Wiring From PLC to Step Motor Driver



Memory clear

Connect to Console (*BR=9600bps, 7E1*)

Connect to HMI (*BR=9600bps, 7E1*)

Non-volatile memory (*except for PLC learning device*)

Support login key word (*if enabled, the user can't read/write/hack, even though the password is correct*)

Error message read out (*the number of error rung in the ladder diagram can be read on D0 at monitoring mode, but D0 is not affected at working mode*)

## 2. Supported instruction set

Please refer to the programming guide for Mitsubishi Fx2N series PLC on the following web site for detail information: <http://www.plc77.com/xzzx.asp>

The following instructions are supported for Fx2N series PLC:

Basic instructions:

LD,LDI,AND,ANI,OR,ORI,INV,OUT,SET,RST,ANB,ORB,LDP,LDF,ANDP,ANDF,ORP,ORF,PLS,PLF,MPS,MRD,MPP,RET,NOP,END.

Step instructions:

STL (supporting up to 8 parallel branches)

Contact comparing:

LD>=,LD<=,LD>,LD<,LD<>,LD=,AND>=,AND<=,AND>,AND<,AND<>,AND=,OR>=,OR<=,OR>,OR<,OR<>,OR=.

Moving and comparing:

MOV,CML,XCH,BCD,BIN,CMP,ZCP, BMOV,FMOV.

Mathematic operation:

ADD,SUB,MUL,DIV,INC,DEC,WAND,WOR,WXOR,NEG.

Rotate shifting:

ROR,ROL,RCR,RCLSFTR,SFTL.

Data manipulation:

ZRST,DECO,ENCO,SUM,BON,MEAN.

Flow control:

CJ (max. 16 address), CALL (nested up to 5 levels, max. 16 subroutines), SRET, FEND, WDT, FOR(nested up to 5 levels), NEXT.

Convenient instruction:

ALT.

High speed processing:

REFF.

PWM (for Y0 and Y1 simultaneously), SPD (X0 only) ,PLSY (Y0 only, 100Hz-20kHz)

Peripheral I/O port:

SEGD.

Peripheral SER instruction:

ASCI.

RS.

Half word swapping:

SWAP.

- Note: Instructions "LDP+LDF+PLS+PLF+MOVP+DMOVP" can not exceed 64.

### 3. Supported resources (can be customized)

Basic soft components:

X0-X37, Y0-Y27.

M0-M255(general type), M512-M768(non-volatile).

S0-S63(general type), S512-S575(non-volatile).

T0-T39 (16-bit timer with 100ms interval),

T200-T215(16-bit timer with 10ms interval),

T250-T257(16-bit non-volatile accumulated timer with 100ms interval).

C0-C23 (16-bit counter), C200 -C207(32-bit up/down non-volatile counter),

C235(32-bit high speed up/down non-volatile counter).

D0-D79(general type), D512-D543(non-volatile)

V0-V7,Z0-Z7 (addressable registers).

Special soft components:

M8000(contact for running status monitored),

M8001(reversed contact for running status monitored),

M8002(contact for initialization pulse),

M8003(reversed contact for initialization pulse),

M8004(contact for error indicator),

M8011(clock pulse with 10ms period),

M8012(clock pulse with 100ms period),

M8013(clock pulse with 1 second period),

M8014(clock pulse with 1 minute period),

M8020(zero flag), M8021(borrow flag), M8022(carry flag),

M8029(flag for end of instruction execution),

M8033(contact for memory retaining),

M8034(contact for output disable),

M8122(request to send),

M8123(completion of receiving),

M8200-M8203(counting direction of C200-C203),

M8235(counting direction of C235),

D8000(setting value of monitoring timer),

D8012(max. scanning time),

D8020(Input filter setting),

D8120(communication format setting,

only Bit0-Bit7 are used for parity check bit, data length and baud rate),

D8140, D8141(register for pulse counting at output Y0).

Constants:

16-bit operation:

K range: -32768~+32767 or 0~65535; H range: 0~FFFFH.

32-bit operation:

K range: -2147483648~+2147483647 or 0~4294967295; H range: 0~FFFFFFFFH.

Memory:

up to 8000 steps.

Supported micro-controllers in PM300 Programmer:

STC11F56XE and STC11F60XE, which can be purchased on the market by user.

#### 4. On-line service

Please visit our web site: <http://www.plc77.com>, and download the latest version of software tools at the link: <http://www.plc77.com/xzzx.asp>.

#### 5. Trouble shooting

##### 1) "RUN" LED is off, and "ERR" LED is on.

Power supply voltage is too low, check if this voltage is 24V.

##### 2) "RUN" LED is off, but "ERR" LED is flashing.

This is an error indication, the possible reasons are:

A. Unsupported instruction or resource (soft component)

B. Address in addressable instruction is out of range

C. Jump, loop, call and edge instructions are out of limits

(LDP+LDF+PLS+PLF+MOVP+DMOVP should not exceed 64)

D. Monitoring timer setting is over range

If the error is caused by A or B, the number of error rung will be saved in D0, which can be read by use of monitoring function.

For example, the unsupported instruction "SFTR" or soft component "D100" is used in rung 126 of ladder diagram, the PLC will stop running (or stop when running to rung 126), and "ERR" LED will flash. At this time, the user can use monitoring function to read the content on D0, this can be done by entering menu: online->monitor->Enter Data Monitor->Register device->, input "D0", and start monitor, "126" will be displayed, that means an error in the rung 126 of the ladder diagram.



If the error is caused by C, D0 will save the number of error rung while the monitoring timer is timeout. For example, if D0 is read as "789" when use of monitoring function, that means the PLC is running to rung 789 while the monitoring timer is timeout. At this time, the timeout value for the monitoring timer D8012 can be set with a larger value to avoid its timeout.

The default timeout value for D8012 is 200, it means the maximal time to allow PLC running through one loop is 200ms. If PLC does not complete one loop within 200ms, it will terminate the program and indicate error by flashing "ERR" LED, meanwhile the all outputs will be closed. The user can add the rung as shown in the right in the ladder diagram, and adjust the timeout value of the monitoring timer to 300ms.



After the trouble is solved, the user should set the "RUN/STOP" button to "STOP" position, then reset it to "RUN" position to cancel the error indication.

Only when an error appears, D0 will be used to save error message. At normal condition, the content of D0 is not affected, the user can use D0 as usual.

3) "RUN" and "ERR" LEDs are flashing simultaneously

PLC memory is fault, the user should power down and power up PLC again. If this error still exists, that means PLC hardware is damaged.

4) "RUN" and "ERR" LEDs light once

It indicates the system resets, that may be caused by interference or some other reason.

5) "ERR" LED is on while PLC is powered off

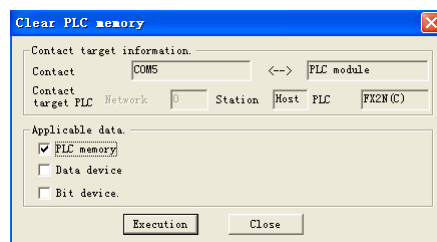
That means the data is saved in non-volatile memory, it is a normal indication.

6) Unable to write "login key word"

A special attention should be taken when setting the login key word for Mitsubishi PLC, in order to write or cancel the login key word successfully, the PLC must be at stop running state.

When login key word is not set (or canceled), the code can be read or written as you wish. After the login key word is set, the code can not be read out and written in, even the login key word itself, this ensures the security of code and product.

In order to cancel login key word, the memory clear action should be done, this also causes the clearing of all ladder diagram, so the user code is protected. The code reading and writing can be done after the login key word is canceled as shown in the right figure.



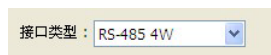
PLC learning device -- PM200 is a helpful and convenient tool for user to learn Mitsubishi PLC. This learning device has the function to set login key word as well even though it could be hacked easily.

The code reading function is not supported for the DIY series PLC (user programmed PLC by PM300) due to the consideration of ease of use during mass deploying in the factory. However, the code written by PM300 can be read by PM300 (no need to insert micro-controller), so remember to clear memory for protecting your code within it.

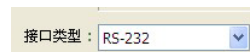
7) Communication with Console and HMI

Because of compatible with Mitsubishi PLC, our products can connect to all Console and HMI that can be connected to Mitsubishi PLC. In the setup menu of Console or HMI, when setting the type of PLC, just select "Mitsubishi FX2n series". The default communication format is BR=9600bps, 7E1.

Please note that the serial port for Mitsubishi PLC is RS-422, but the port type for our products is RS-232. For some HMI, it is necessary to select the port type, for example, the TK6080 from Welch, it is required to select "RS-485" to connect Mitsubishi PLC as shown in the right figure.



In order to connect our PLC, it is necessary to choose "RS-232" as shown in the right figure.



Please use the provided communication cable to connect our PLC and the Console or HMI. If

the user wants to make the cable by himself, the straight connection of pin2 (RXD), pin3 (TXD) and pin5 (GND) between two DB9 connectors, no crossed connection is required, and other pins in DB9 are un-connected (float).

#### 8) About RS-232 and RS-485 (or RS-422)

The serial port "RS-232" and "RS-485" are different interface types in hardware, it is nothing with software, the conversion from one to another by hardware is possible.



The cable for RS-232 is cheap, but it supports a short communication distance. It is recommended to use RS-232 cable within 5 meters in order to ensure reliable communication especially in the factory field for industry automation.

The cable for RS-485 can support a long distance communication, there is no problem for hundreds of meters, but the cable cost is higher.

RS-232 and RS-485 are the communication interface, Console and HMI are the device to be communicated, they are not linked directly with the communication protocol implemented by software. Our products support both interfaces and both devices for communication.

If the user needs a long distance communication when using our PLC, it is necessary to convert the RS-232 interface to RS-485, this can be done by using a RS-232 to RS-485 converter, it is recommend to use the isolated type, which can provide higher immunity to interference, even though its cost is higher. The cable can be made by yourself as well, simply connecting the same signal line between the PLC and the Console or HMI. No software setting is needed.

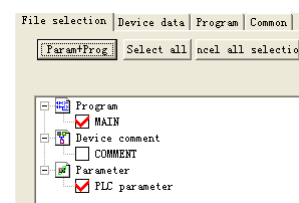
#### 9) Error indication

Normally it is caused by the setting of memory. If the memory capacity is set with a small value in the last time, and you set a large value while downloading the code, this error indication will pop up as shown in the right figure. There 2 methods to solve this problem.



A. Set the same memory capacity value between different use.

B. When downloading, set the parameter to be downloaded as well, refer to the right figures.



### 5. Downloading example routines at <http://www.plc77.com/xzzx.asp>

### 6. Refer application notes at <http://www.plc77.com/wz.asp>

### 7. Wiring

For the provided switching power supply module, The terminals "L" and "N" should be connected to the mains power supply, e. g. AC220V, The grounding  $\perp$  terminal should be



connected to the chassis or just float. The terminal "-V" or "G" should be connected to the "GND" of PLC, the terminal "V" or "+V" should be connected to "24V" of PLC, the last terminal "VADJ" is used for fine tune of the output voltage which is calibrated already at manufacturer.

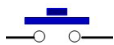
The legends used in the following wiring diagram:



**DC power supply**, the terminal with "+" means positive polarity, e.g. the terminal "V" or "+V" of power supply. The other terminal means negative polarity, e.g. The terminal "-V" or "G" of power supply.



**Load**, it can represents relay, valve, heater, lighter, and motor, etc. Some relay or valve have polarity, connect its positive terminal to "24V" of PLC, and negative terminal to output of PLC.



**Switch**, it can be a button-switch, position-switch, sensor, or contact, etc. For sensors with 3 terminals, normally connect the power supply and ground of sensor to the terminal of power supply and ground of PLC, the third terminal, i.e. the signal output of the sensor, should be connected to the terminal "X" of PLC.



