CP and NB HMI Print Label Quick Start Guide

Print a label with barcode on a HP Laser printer

This document explains:

- Hardware configuration.
- Load barcode font to the printer.
- Using the NB HMI demo program.
- NB HMI sample code.
- PLC sample code .

Product(s):
CP1L-E or CP2E-N PLC
NB HMI
HP® Laser printer M203dw

CX-ONE V4.50 → CX-Programmer V9.75
NB-Designer V1.501 build 200303

Barcode font supplier:
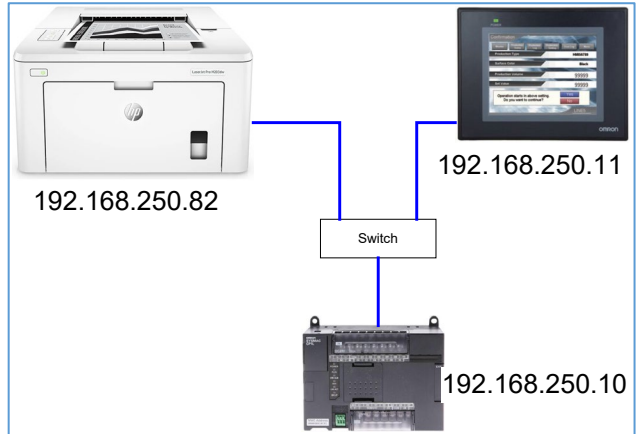IDAutomation®.com

Date: 2020/08/06

1   Table of Contents

1. Ethernet cables connections

1.1 CP1L-E connections

Using an Ethernet switch to connect the CP1L-E, NB HMI, and the printer.

Figure 1: CP1L-E connection2

192.168.250.82

192.168.250.11

Switch

192.168.250.10
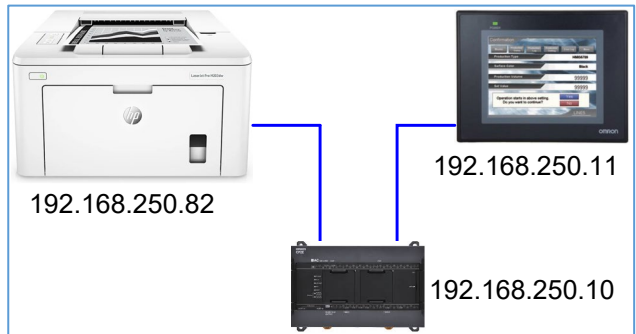
1.2 CP2E-N connections

It is possible to connect the NB HMI and printer to the CP2E-N. The CP2E-N have two Ethernet ports which act as a switch.

Figure 2: CP2E-N connections

192.168.250.82

192.168.250.11

192.168.250.10

2 Installing barcode font to printer

2.1 Code 39 barcode font

Depending on the printer make and model, the printer manufacture can provide barcode font as an add-on and some printer have pre-loaded barcode font. The other option is to purchase barcode font and load them to your printer.
For this demo, IDAutomation®.com code39 barcode font demo was used.
The instruction to load the font may or may not be the same for your printer. Please consult your printer manufacture and the font provider for their instruction.

Note: Using this method the font is loaded to the printer RAM memory. The loaded font information will be deleted when the printer power is turned off.

The following instruction is for loading the IDAutomation®.com code 39 barcode font demo to the HP® Laser Jet Pro M203dw via Ethernet connection.

1. Due to licensing, you'll have to go the website and download the demo (https://www.idautomation.com/barcode-fonts/code-39/download/)
2. In the code 39 font demo select the PCL folder. PCL (HP's Printer Command Language) fonts is chosen because the PLC will send PCL command to the printer.
3. Modified the TEST.BAT batch file to load the code 39 font to the printer via Ethernet. The instruction on how to load the TEST.BAT is provided in "pclinfo.html" file.

This is the modified TEST.BAT to load code 39 font to the printer via Ethernet:

```
copy /B c70D.txt +H39M12.SFP +c5F.txt +data.txt total.bin

lpr -S 192.168.250.82 -P RAW -ol total.bin

pause
```

copy/B	Combine the four files into one file call total.bin.
c70D.txt	Contains command that assign code39 font to printer font ID.
H39M12.SFP	This is a font file
c5F.txt	Contains command to make this a permanent font.
data.txt	Contains commands to select code39 font and print a test barcode. "IDAutomation Code 39 Font Manual.pdf" contains information on how to format the barcode string for printing.
lpr	Command for sending a file to the printer
192.168.250.82	This is the printer IP address

The data.txt was modified to work with the HP® printer.

IDAutomation.com PCL Printer Test File		
(70X	<ESC>(70X	This command select the code39 font.
1234ABCD	1234ABCD	This is the barcode data.
E	<ESC>E	Print command for the HP printer.

Note: Execute the TEST.BAT by right click on the file and select Run as administrator.
The total path length where TEST.BAT is located cannot exceed 128 characters.

3 How to run the CP and NB HMI demo

3.1 NB HMI: Print Label screen

If this is the first time using this demo the user need to select the [Setup Screen] button to enter the printer IP address. See 3.2 NB HMI: Setup screen.

On the Print label screen the user can select one of four selection buttons that will add the pre-defined text to be printed on the label. The text input box allow the user to add up to thirty-two characters to the label. A code 39 barcode will be printed with user readable text "OMRON" and minute and second.

When the [Connect To Printer] button; execute a TCP Active Open command, is pressed the [Print] button will appear. See figure 4.

The [Print] button will execute a TCP Send command to print the label.

The [Disconnect Printer] button will execute a TCP Close command. The close command can take up to 120s to complete the close.
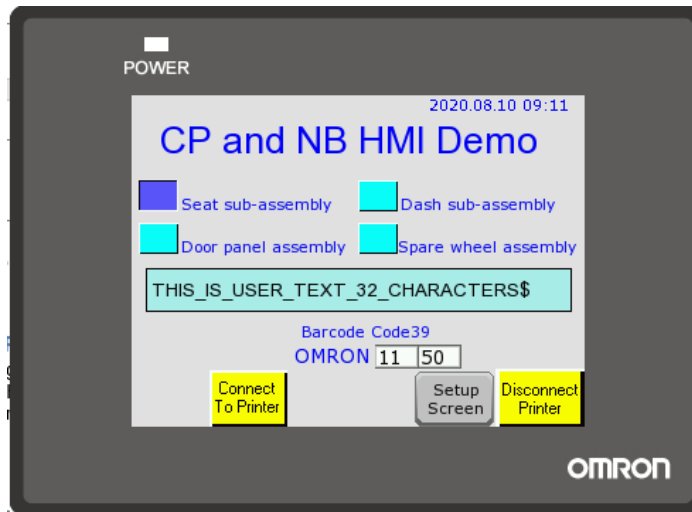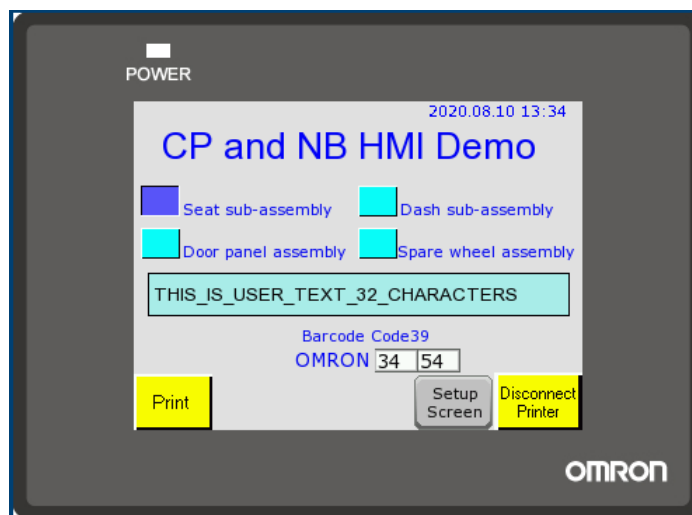
Figure 3

Figure 4

3.2 NB HMI: Setup screen

User can setup the printer IP address, set the NB HMI date and time, and monitor the PLC's Ethernet TCP communication status.

Printer IP address is the IP address of the printer that is entered. Change printer IP address let the use enter the IP address of the printer.

The [clock] button let the user edit the NB HMI date and time.

The [Clear ETN Error] button, reset Ethernet comm error, will be visible when an Ethernet comm error occurs.

TCP connection status: display the status code and the description will scroll across the bottom of the status code.

TCP response code: display the response and the description will scroll across the bottom of the response code.

Figure 5
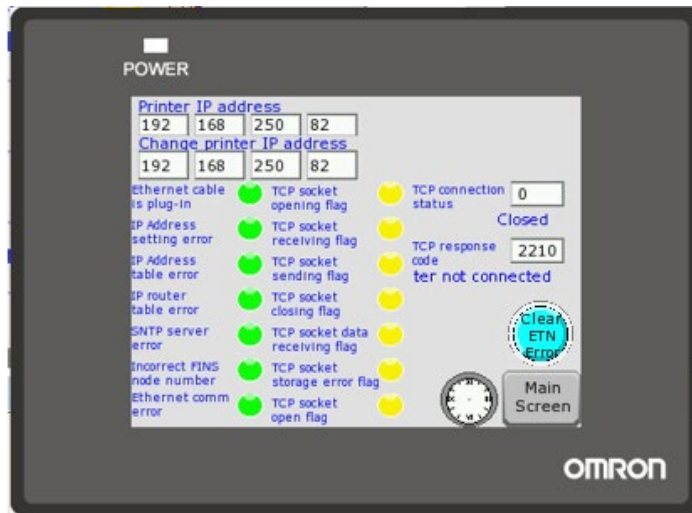
3.3 NB HMI: Edit NB HMI Date and Time popup

Press the [clock] button to display the edit NB HMI data and time popup window. User can edit the date and time of the NB HMI. Press the [X] button to close the popup.

Figure 6

3.4   Label printout

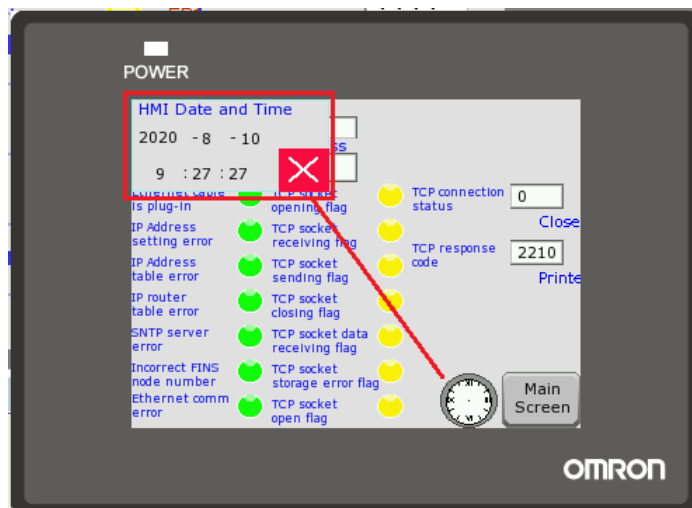This is a sample of the label printed

Fixed text
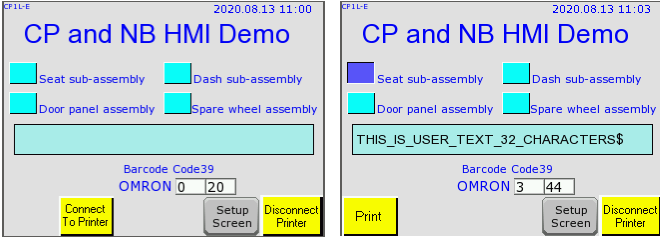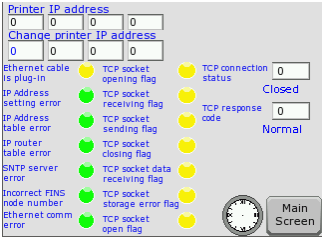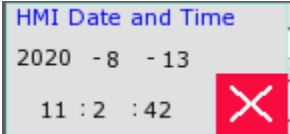
Selection button pre-defined text

User text input

Code 39 barcode

User readable text

4   NB HMI sample code

4.1   NB program

The NB HMI sample program have two screens, one popup screen, two macros, and event settings.

Screens, macros, and settings	Description
Print Label screen	This is the main screen for user selections, enter use text, connect and print to the printer. *(screen images: "CP and NB HMI Demo" with Seat sub-assembly, Dash sub-assembly, Door panel assembly, Spare wheel assembly, Barcode Code39 OMRON, Connect To Printer, Setup Screen, Disconnect Printer, Print buttons)*
Setup screen	This screen allows user to enter the printer IP address, monitor the Ethernet connections status, and change the NB HMI date and time. *(screen image: Printer IP address, Change printer IP address, Ethernet cable is plug-in, IP Address setting error, IP Address table error, IP router table error, SNTP server error, Incorrect FINS node number, Ethernet comm error, TCP socket flags, TCP connection status Closed, TCP response code Normal, Main Screen button)*
Set HMIDateTime popup screen	This is the popup screen to change the NB HMI date and time. *(screen image: HMI Date and Time 2020 -8 -13 11 :2 :42)*
| Macro_0.c | This macro read the minutes and seconds from the NB HMI clock. The minutes and seconds are display on Print Label screen and written to the PLC.<br><br>```c
int MacroEntry()
{
    /*
    Read the minutes and seconds from the NB HMI
    and display on Print Label screen and
    written to the PLC
    */
    PLC_Sec = NB_Sec;
    PLC_Min = NB_Min;
    return 0;
}
``` |

Macro_1.c	This macro convert the IP address enter by the user to two HEX values for the PLC socket service parameter area.
	```c int MacroEntry() { /* Convert the user input of the IP addres to two HEX values for the PLC socket service parameter area */ IPAdd_A = IPAdd1 * 256 + IPAdd2; IPAdd_B = IPAdd3 * 256 + IPAdd4; return 0; } ```
Event Setting	No. 0 trigger maco_1.c when user enter the printer IP address. No. 1 to 11 enumerate the TCP connection status. It convert the status to a text message. No. 12 to 16 enumerate the TCP response code. It convert the response code to a text message.

Event Setting

No.	Type	P.	Address inform...	Address	T...	Condition	Message
0	0	0	HMI0:PLC0:10	LB:0	On		Set printer IP Address
1	1	0	HMI0:PLC0:10	D:32404		== 0	Closed
2	1	0	HMI0:PLC0:10	D:32404		== 1	Listen
3	1	0	HMI0:PLC0:10	D:32404		== 2	Syn send
4	1	0	HMI0:PLC0:10	D:32404		== 3	Syn received
5	1	0	HMI0:PLC0:10	D:32404		== 4	Established
6	1	0	HMI0:PLC0:10	D:32404		== 5	Closed wait
7	1	0	HMI0:PLC0:10	D:32404		== 6	Fin wait 1
8	1	0	HMI0:PLC0:10	D:32404		== 7	Closing
9	1	0	HMI0:PLC0:10	D:32404		== 8	Last ack
10	1	0	HMI0:PLC0:10	D:32404		== 9	Fin wait 2
11	1	0	HMI0:PLC0:10	D:32404		== 10	Time wait (HEX = A)
12	2	0	HMI0:PLC0:10	D:32417		== 0	Normal
13	2	0	HMI0:PLC0:10	D:32417		== 770	Cannot execute (HEX=302)
14	2	0	HMI0:PLC0:10	D:32417		== 8720	Socket not connected (HEX=2210)
15	2	0	HMI0:PLC0:10	D:32417		== 261	Local IP address setting error (HEX=0105)
16	2	0	HMI0:PLC0:10	D:32417		== 83	Printer not power or cable disconnected (HEX=0053)

5 PLC sample code

5.1 Using socket services

The PLC use socket services to send the PCL (Printer Command Language) to the printer. Depending on the printer manufacture sending the PCL command could be different but the concept will be the same.
The PLC is the client which initiates all the communication and the printer is the server which process the commands therefore the PLC will use TCP active open to make the connection to the printer.

5.2 PLC memory map

The following tables list the memory words and bits associated to socket1 for CP1L-EM and CP2E-N.

Ethernet Auxiliary Area: control bits and status flags

Description	CP1L-EM	CP2E-N
Ethernet status - Link status flag	A45.14	A45.14
Ethernet status - IP Address setting error flag	A46.02	A46.02
Ethernet status - IP Address table error flag	A46.03	A46.03
Ethernet status - IP router table error flag	A46.04	A46.04
Ethernet status - DNS server error flag	A46.05	A46.05
Ethernet status - routing table error flag	A46.06	A46.06
Ethernet status - SNTP server error	A46.11	A46.11
Ethernet status - Address disagreement flag	A46.14	A46.14
Ethernet status - Ethernet communication error flag	A46.15	A46.15
Ethernet status - FINS/TCP connection flag 1	A47.00	A47.00
Ethernet status - FINS/TCP connection flag 2	A47.01	A47.01
Ethernet status - FINS/TCP connection flag 3	A47.02	A47.02
Ethernet service request - Socket force-close switch	A566.02	A566.02
Ethernet communication error clear bit	A500.11	A500.11

Ethernet socket 1 Auxiliary Area: control bits and status flags

Description	CP1L-EM	CP2E-N
	UDP or TCP socket 1	UDP or TCP socket 1
TCP socket status - Opening flag	A567.00	A567.00
TCP socket status - Receiving flag	A567.01	A567.01
TCP socket status - Sending flag	A567.02	A567.02
TCP socket status - Closing flag	A567.03	A567.03
TCP socket status - Data receiving flag	A567.13	A567.13
TCP socket status - Result storage error flag	A567.14	A567.14
TCP socket status - TCP/UDP open flag	A567.15	A567.15
Socket service request - UDP open request switch	A571.00	A571.00
Socket service request - TCP passive open request switch	A571.01	A571.01
Socket service request - TCP active open request switch	A571.02	A571.02
Socket service request - send request switch	A571.03	A571.03
Socket service request - receive request switch	A571.04	A571.04
Socket service request - close request switch	A571.05	A571.05

Ethernet socket 1 Data Memory Area: socket service parameter area

Description	CP1L-EM	CP2E-N
	UDP or TCP socket 1	UDP or TCP socket 1
TCP socket number of bytes received	D32400	D16000
TCP connection status -	D32404	D16004
UDP/TCP socket number	D32408.00 to D32408.07	D16008.00 to D16008.07
Socket option - TCP open active or passive - keep alive	D32408.08	D16008.08
Local UDP/TCP port number	D32409	D16009
Remoter IP Address - upper word	D32410	D16010
Remoter IP Address - lower word	D32411	D16011
Remote UDP/TCP port number	D32412	D16012
Number of bytes to send or receive	D32413	D16013
Send or receive data address - leftmost 2 digits	D32414.00 to D32414.07	D16014.00 to D16014.07
Send or receive data address - memory area designation	D32414.08 to D32414.15	D16014.08 to D16014.15
Send or receive data address - rightmost 2 digits	D32415.00 to D32415.07	D16015.00 to D16015.07
Send or receive data address - bit number	D32415.08 to D32415.15	D16015.08 to D16015.15
Timeout value	D32416	D16016
Response code	D32417	D16017

5.3 PCL – Printer Command Language

These are the PCL commands used in the demo.
All the PCL command start with <ESC> hence they are call escape code.

PCL command	Description
<ESC>*p0050x0050Y<ESC>(35<ESC>(s1p36v0s0b16602T*text string*	<ESC>*p0050x0050Y set print start x and y location. The default x and y unit is 1 unit = 1/300". <ESC>(35 set the font ID number = Arial. <ESC>(s1p36v0s0b16602T set the font pitch, height, style, weight, and typeface. Text string are printer text.
<Esc>*p0050x0350Y<ESC>(24<ESC>(s0p10h0s0b4099T*text string*	<ESC>(24 set the font ID number = Courier.
<ESC>*p0180x0650Y<ESC>(70X(*text string*)<ESC>E	<ESC>(70X set the font ID number = code 39 barcode. (text string) is human readable text inside the (). <ESC>E is the command to print

5.4 PLC program

The PLC program have four sections SetData, TCP_Active_Open_S1, TCP_Close_S1, and TCP_Send_S1.

Program sections	Description
SetData	This section initialize the PLC data memory and contain the program that interact with the NB HMI. Rung 1 FB_FixedData function block loads the PCL commands and the user selection text strings to the PLC data memory. This is the same as downloading a data memory file.
TCP_Active_Open_S1	This section setup the PLC socket services parameter area for TCP active open of socket 1. Rung 2 sets the PLC TCP port to 2000 but can be changed. The printer IP address is set in the NB HMI but could be hard coded using rung 3 and 4. Rung 5 sets the printer TCP port number. The default port number is 9100 but could be different depending on the printer setup.
TCP_Close_S1	This section close the TCP port.
TCP_Send_S1	This section setup the PLC socket services parameter area for TCP send from socket 1. The send message is stored in start address D200 and the message size is 240 bytes. The maximum message size for each TCP send is 1024 bytes.

6 Appendix:

6.1 Reference manual

W451-E1 CP1H/CP1L CPU Unit programming Manual
W516-E1 CP1L-EL/EM CPU Unit Operation Manual
W613-E1 CP2E CPU Unit Hardware User's Manual
W614-E1 CP2E CPU Unit Software User's Manual
W483-E1 CP1E/CP2E CPU Unit Instructions Reference Manual

6.2 Reference web-link

PCL 5 Printer Language Technical Reference Manual Part I
http://www.hp.com/ctg/Manual/bpl13210.pdf

PCL 5 Printer Language Technical Reference Manual Part II
http://www.hp.com/ctg/Manual/bpl13211.pdf

PCL 5 Printer Language Technical Quick Reference Guide
http://www.hp.com/ctg/Manual/bpl13205.pdf

PCL 5 Comparison Guide
http://www.hp.com/ctg/Manual/bpl13206.pdf

Printer font's supplier
https://www.idautomation.com/

OMRON

Authorized Distributor:

Controllers & I/O
• Machine Automation Controllers (MAC) • Motion Controllers
• Programmable Logic Controllers (PLC) • Temperature Controllers • Remote I/O

Robotics
• Industrial Robots • Mobile Robots

Operator Interfaces
• Human Machine Interface (HMI)

Motion & Drives
• Machine Automation Controllers (MAC) • Motion Controllers • Servo Systems
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Vision, Measurement & Identification
• Vision Sensors & Systems • Measurement Sensors • Auto Identification Systems

Sensing
• Photoelectric Sensors • Fiber-Optic Sensors • Proximity Sensors
• Rotary Encoders • Ultrasonic Sensors

Safety
• Safety Light Curtains • Safety Laser Scanners • Programmable Safety Systems
• Safety Mats and Edges • Safety Door Switches • Emergency Stop Devices
• Safety Switches & Operator Controls • Safety Monitoring/Force-guided Relays

Control Components
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Software
• Programming & Configuration • Runtime