# arve HITACHI PROGRAMMABLE AUTOMATION CONTROLLER

entative

# **HX** Series

in ve l'entative

## **APPLICATIN MANUAL (Software)** (SERVICE MANUAL)

entative

entativo.

NJI-638(X)

Tentai

#### O Warranty period and coverage

The warranty period is the shorter period either 18 months from the data of manufacture or 12 months from the date of installation.

However within the warranty period, the warranty will be void if the fault is due to;

- (1) Incorrect use as directed in this manual and the application manual.
- (2) Malfunction or failure of external other devices than this unit.
- (3) Attempted repair by unauthorized personnel.
- (4) Natural disasters.

The warranty is for the PLC only, any damage caused to third party equipment by malfunction of the PLC is not covered by the warranty.

#### O Repair

Any examination or repair after the warranty period is not covered. And within the warranty period ant repair and examination which results in information showing the fault was caused by ant of the items mentioned above, the repair and examination cost are not covered. If you have ant questions regarding the warranty please contact wither your supplier or the local Hitachi Distributor. (Depending on failure part, examination might be impossible.)

#### O Ordering parts or asking questions

When contacting us for repair, ordering parts or inquiring about other items, please have the following details ready before contacting the place of purchase.

- (1) Model
- (2) Manufacturing number (MFG.NO.)
- (3) Details of the malfunction

#### O Reader of this manual

This manual is described for the following person.

- Person considering the introduction of PLC
- PLC system engineer
- Person handling PLC
- Manager after installing PLC

11

#### Warning

- (1) This manual may not be reproduced in its entirety or ant portion thereof without prior consent.
- (2) The content of this document may be changed without notice.
- (3) This document has been created with utmost care. However, if errors or questionable areas are found, please contact us.

Windows 2000 / XP / 7 / 8 / 10 are registered trademarks of America and other registered countries of Microsoft Corp. of the United States.

## Safety Precautions

Read this manual and related documents thoroughly before installing, operating, performing preventive maintenance or performing inspection, and be sure to use the unit correctly. Use this product after acquiring adequate knowledge of the unit, all safety information, and all cautionary information. Also, make sure this manual enters the possession of the chief person in charge of safety maintenance.

Safety caution items are classifies as "Danger" and "Caution" in this document.



: Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible death or severe injury.



: Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible minor to medium injury to the body, or only mechanical damage

However, depending on the circumstances, items marked with



may result in major accidents.

In any case, they both contain important information, so please follow them closely.

Icons for prohibited items and required items are shown blow:

Solution: Solution is shown.

: Indicates required items (items that must be performed). For example, when grounding must be performed,

is shown.

#### 1. About installation

## 

- Use this product in an environment as described in the catalog and this document. If this product is used in an environment subject to high temperature, high humidity, excessive dust, corrosive gases, vibration or shock, it may result in electric shock, fire or malfunction.
- Perform installation according to this manual. If installation is not performed adequately, it may result in dropping, malfunction or an operational error in the unit.
- Do not allow foreign objects such as wire chips to enter the unit. They may become the cause of fire, malfunction or failure.

41

#### 2. About wiring

## REQUIRED

• Always perform grounding (FE terminal).

If grounding is not performed, there is a risk of electric shocks and malfunctions.

## ▲ CAUTION

- Connect power supply that meets rating. If a power supply that does not meet rating is connected, fire may be caused.
- The wiring operation should be performed by a qualified personnel. If wiring is performed incorrectly, it may result in fire, damage, or electric shock.

#### 3. Precautions when using the unit

## DANGER

- Do not touch the terminals while the power is on. There is a risk of electric shock.
- Structure the emergency stop circuit, interlock circuit, etc. outside the programmable controller (hereinafter referred to as PLC).

Damage to the equipment or accidents may occur due to failure of the PLC.

However, do not interlock the unit to external load via relay drive power supply of the relay output module.

## ▲ CAUTION

• When performing program change, forced output, RUN, STOP, etc., while the unit is running, be sure to verify safety.

Damage to the equipment or accidents may occur due to operation error.

• Supply power according to the power-up order.

'IVE

Damage to the equipment or accidents may occur due to malfunctions.

## 

• Use power supply unit of EH-PS series for supplying electric power.

## 

• Do not connect DC power supply module EH-PSD to a master power circuit. Supply a power to EH-PSD through an appropriate isolation transformer less than up to 150VA by all means.

4. About preventive maintenance

## DANGER

- Do not connect the ⊕, ⊖ of the battery in reverse. Also, do not charge, disassemble, heat, place in fire, or short circuit the battery.
  - There is a risk of explosion or fire.

## 🕲 PROHIBITED

• Do not disassemble or modify the unit. Electric shock, malfunction or failure may result.

## 

entativ,

Pontativo

• Turn off the power supply before removing or attaching module/unit. Electric shock, malfunction or failure may result.

shidive

entative

## Revision History

'ali

	Revision	History	Ĺ	
No.	Description of revision		Date of revision	Manual number
1 The first edit	on		2016.07	NJI-638(X)
	6	2		
				6

#### Table of contents

Table of contents	
Chapter 1 Prepared HX-CODESYS	1-1 ~ 1-8
1.1 Prepareation of Installation 1.1 Installation	1-1
1.1.1 Insttallation of HX-CODESY	
1.1.2 Instrallation USB driver	
1.2 Start up	

Chap	ter 2 Prog	gramming	2-1 ~ 2-38
2.1	Add de	evice (I/O configuraion)	2-1
	2.1.1	Plug device (I/O configuration)	
	2.1.2	Scan for devices (Read out I/O from connected CPU)	
	2.1.3	Expansion unit	
	2.1.4	Upadate devices	
	2.1.5	I/O address	
2.2	l/O refi	resh	
2.3	POU a	nd task	2-13
2.4	Availat	ble characters for variable names	
2.5	Vareat	ble	2-17
	2.5.1	Data memory	
	2.5.2	Marker memory	
	2.5.3	Constant	
	2.5.4	Data types	
	2.5.5	Local vareable	
	2.5.6	Global vareable	
2.6	6 Config	uration	2-22
2.7	' Comm	unication setting	2-23
2.8	8 Progra	mming	2-25
2.9	) Login /	Logout	2-27
2.1	0 Boot a	pprication	2-30
2.1	1 Source	e download / uploard	2-31
2.1	2 Run / S	Stop / Reset / Initialize	2-32
2.1	3 Global	netowrk vareable	2-34
2.1	4 Library	,,,,,,,	
2.1	5 Versio	n	

Chapte	er 3 Coc	3-1 ~ 3-29	
3.1	Ether	CAT master	
	3.1.1	Setting	
	3.1.2	Ethernet communication speed	
	3.1.3	Cycle of EtherCAT task	
	3.1.4	Programming	
	3.1.5	Wireing	
3.2	Modbu	JS-TCP/RTU	
	3.2.1	Overview	
	3.2.2	Modbus-TCP master (Client)	
	3.2.3	Modbus-TCP slave (Server)	
	3.2.4	Modbus-RTU master	
	3.2.5	Modbus-RTU slave	
3.3	CPU L	.ink	
	3.3.1	Overview	
	3.3.2	Configuration link parameters	
	3.3.3	Declaration of Link Variable	

3.4	FL-net	t interface	3-21
	3.4.1	Overview	3-21
	3.4.2	Configuraiotn FL-net parameters	3-22
	3.4.3	Cyclic transfer	3-23
	3.4.4	Massage transfer	3-24
	3.4.5	Statua monitor library	3-24
3.5	Profibu	us master	3-26
	3.5.1	Overview	3-26
	3.5.2	Configuration link parameters	3-26
3.6	Genera	al purpose communication	3-28
	3.6.1	General purpose communication over Ehernet	3-28
	3.6.2	General purpose communication over serial	3-29

#### Chapter 4 Other fucctions 4-1 ~ 4-32 4.1 4.2 4.3 4.4 4.5 4.6 4.7

Chapter 5 Debugging function 5-1 ~		5-1 ~ 5-13
5.1	How to start	
5.2	Monitor function	
5.3	Flow control function	5-6
5.4	Break point function	
5.5	Single cycle step function	5-8
5.6	Value force set and write value function	5-9
5.7	Trace function	5-11

Appendix Known districtions

entative

entative

A-1 ~ A-5

entai



## Chapter 1 Prepared HX-CODESYS

## 1.1 Installation

#### 1.1.1 Installation of HX-CODESYS

CODESYS のインストールを開始する前に、他の Windows アプリケーションを実行している場合は終了さ せてからインストールを開始してください。終了させない場合は正常にインストールできない場合があり ます。

1. The installation wizard starts up automatically by double click "Setup\_HX-CODESYSV35SP8Patch4.exe" on EHV-CODESYS installation CD.



さ		
Setup HX-C ODESYSV3		
5SP8Patch4 Texe		
2. Follow the instructions		
HX-CODESYS V3.5 SP8 Patch 4 - InstallShield Wizard	HX-CODESYS V3.5 SP8 Patch 4 - InstallShield Wizard	
Welcome to the InstallShield Wizard for HX-CODESYS V3.5 SP8 Patch 4	License Agreement Please read the following license agreement carefully.	
The InstallShield Wizard will install HX-CODESYS V3.5 SP8 Patch 4 on your computer. To continue, click Next	Press the PAGE DOWN key to see the rest of the agreement.	
	PLEASE READ THIS TERMS OF USE AGREEMENT CAREFULLY BEFORE USING THE HX-CODESYS SOFTWARE SUPPLIED.	
	THE HX-CODESYS SOFTWARE PLACED AT YOUR DISPOSAL IS PROTECTED BY COPYRIGHT AND OTHER INTELLECTUAL PROPERTY LAWS. THE FOLLOWING TERMS ARE AGREED BETWEEN YOU AS THE SOFTWARE USER AND THE COMPANY HITACHI INDUSTRIAL EQUIPMENT SYSTEMS CO., LTD., IN KANDA-	
	Do you accept all the terms of the preceding License Agreement? If you select No, the setup will close. To install HX-CODESYS V3.5 SP8 Patch 4, you must accept this agreement. InstallShield	_
< <u>₿</u> ack Next > Cancel	< <u>B</u> ack Yes No	
HX-CODESYS V3.5 SP8 Patch 4 - InstallShield Wizard	HX-CODESYS V3.5 SP8 Patch 4 - InstallShield Wizard	
Choose Destination Location Select folder where setup will install files.	Select Features Select the features setup will install.	
Setup will install HX-CODESYS V3.5 SP8 Patch 4 in the following folder.	Select the features you want to install, and deselect the features you do not want to install.	
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.	HX-CODESYS     CODESYS Converter     CODESYS Gateway     CODESYS Gateway     CODESYS Gateway     CODESYS Gateway     CODESYS Gateway     CODESYS Gateway     CODESYS Control Win V3	91
Destination Folder		
C:\Program Files\HX-CODESYS\ Browse	2.47 GB of space required on the C drive 4.34 GB of space available on the C drive	
Instalishield Cancel	Instalishield Cancel	
	-1	

HX-CODESYS V3.5	SP8 Patch 4 - InstallShield Wizard		HX-CODESYS V3.5 SP8 Patch 4 - Insta	allShield Wizard	×
Select Program F Please select a pro	<b>older</b> ogram folder.	X	Start Copying Files Review settings before copying files.		
Setup will add proy name, or select on Program Folder:	gram icons to the Program Folder listed below. Ye e from the existing folders list. Click Next to conti	ou may type a new folder inue.	Setup has enough information to start cop change any settings, click Back. If you ar copying files. Current Settings:	ying the program files. If you want to review or e satisfied with the settings, click Next to begin	n
Existing Folders: 35 CODESYS			Selected Features: HX-CODESYS CODESYS Converter CODESYS Gateway		
			CODESYS Control Win V3 CODESYS OPC Server 3 CODESYS Gateway V2.3		E
		~		III	+
InstallShield	< <u>B</u> ack	Next > Cancel	InstallShield	< <u>B</u> ack Next > Ca	incel
HX-CODESYS V3.5	SP8 Patch 4 - InstallShield Wizard		HX-CODESYS V3.5 SP8 Patch 4 - Inst	allShield Wizard	×
Setup Status		NEA -	Very important information		Z
HX-CODESYS V3	5 SP8 Patch 4 is configuring your new software i	installation.	Compatibility Information		<b>^</b>
			Automation Platform User Management (CDS-28943)		
			Important note for Automation Pla There is a behavioral change in the ICommandManagerXX.ExecuteXX( user is not authorized to execute it	tform customers: e various () methods for those cases where the the command by means of the User	
			Management  I have read the information  L have not read the information		
InstallShield			InstallShield		
		Cancel		< <u>B</u> ack <u>N</u> ext > La	incel
HX-CODESYS V3.5	SP8 Patch 4 - InstallShield Wizard				
	InstallShield Wizard Complete	e			
	HX-CDDESYS V3.5 SP8 Patch 4. wizard.	Click Finish to exit the			
	< <u>B</u> ack	Finish Cancel			
	Y				
インストー	ル完了まで 30 分程度の	の時間を要します。			

#### 注意

インストール先のパソコンには.NETFramework 4.0 が必要です(WindowsXP SP3 の場合)。これ がインストールされていない場合には HX-CODESYS のインストールは停止し、右図の 画面が表示されます。[Install]をクリックする と、.NET フレームワークをインターネットからダ ウンロードすることができます。パソコンがイン ターネットに接続していない場合は[Cancel]をク リックして、HX-CODESYSのCD-Rからインスト ールしてください。

HX-CODESYS V3.5 SP8 Patch 2 - InstallShield Wizard

HX-CODESYS V3.5 SP8 Patch 2 requires the following items to be installed on your computer. Click Install to begin installing these requirements. ىك

Status	Requirement	^
Succeeded Pending Pending Pending Pending Pending Pending	Microsoft Visual C++ 2005 SP1 Redistributable MFC Security Update KB253824 Windows Installer 3.1 (x86) Microsoft Visual C++ 2010 SP1 Redistributable Package (x86) Microsoft Visual C++ 2008 SP1 Redistributable MFC Security Update KB253824 Windows Imaging Component (x86) Microsoft .NET Framework 4.0 Full (Web Download) Microsoft .NET Framework 3.5 SP1 (Web Download)	2) 3)
	g: WindowsInstaller-KB893803-x86.exe	
	•••••	

Cancel

entative.

#### 1.1.2 USB ドライバのインストール

6

1. Plug in USB cable to CPU module.



USB device port (Type:miniB)

USB ケーブルは製品に同梱されておりません。 ノイズによる通信エラーを防止するため、フェライトコア付の USB ケーブル(A - miniB)をお求め、ご使用ください。

2. Popup window appears at right-bottom of screen. Click the popup window.

•	デバイス ドライバー ソフトウェアをインストールしています	9	x
-	ステータスを見るには、ここをクリックしてください。		_
	🤍 A 般 🐸 🥔 🕐 🕬 🗸	_	7

3. Windows Update からのドライバーソフトウェアの取得をスキップします。

🕕 ドライバー ソフトウェアのインストール	<b>—</b> X
デバイス ドライバー ソフトウェアをインストールしています	
USB_HX Driver OWindows Update ?	を検索しています
ドライバー ソフトウェアを Windows Update から取得すると、時間が す。 Windows Update からのドライバー ソフトウェアの取得をスキップす	かかる場合がありま <u>る</u>
	閉じる(C)
e l'	1-

4. ドライバソフトウェアのインストールを一日終了します。

• • • • • • • • • • • • • • • • • • • •		/0	_
🕕 ドライバー ソフトウェアのイ	ンストール	<b>×</b>	
デバイス ドライバー ソフトウェ	アは正しくインストールされませんでした。		26
USB_HX Driver	🗙 ドライバーが見つかりません	v.	
デバイスを正しくインストールで	きない場合		(2x)
		閉じる(C)	

5. デバイスマネージャを開き、他のデバイスとして表示されている USB\_HX\_Driver を 右クリックし、ドライバーソフトウェアの更新をクリックします。

	-
ファイル(F) 操作(A) 表示(V) ヘルプ(H)	
GUJPE2CZ32PK747	
▶ · 🛃 DVD/CD-ROM ドライブ	
> 🥁 IDE ATA/ATAPI コントローラー	
▶ ·=== キーボード	
▶ ● サワント、ビデオ、およびケーム コントローラー	
▶ 📲 ディスプレイ アダプター	
▶ 👰 ネットワーク アダプター	
「 「 ヒューマン インターフェイス デバイス	
▶·マホート (COM と LPT)	
▶·ハ マウスとも ドライバー ソフトウェアの更新(P)	
無効(D)	
▶·■ ユニバー+ 削除(U)	
ハードウェア変更のスキャン(A)	
プロパティ(R)	
1-4	

6. ドライバーを手動で検索を選択し、下記のフォルダを指定します。

<i>(</i>		
	🧕 ドライバー ソフトウェアの更新 - USB_HX Driver	
	コンピューター上のドライバー ソフトウェマを参照します	
	コンビューターエのトントハーシントウェアを参照します。	
	次の場所でドライバー ソフトウェアを検索します:	
	C.++rogram Files+nx-coolcara+sateway+LC+biver ◆ 参照(图)	
	☑ サブフォルダーも検索する(1)	
	→ コンピューター上のデバイス ドライバーの一覧から選択します(L)	
	この一覧には、デバイスと互換性があるインストールされたドライバー ソフトウェア	
_	と、テハイスと向し力テゴリにあるすべてのトライハー ソノトウエアが表示されます。 す。	
	次へ(N) キャンセ	
7	*ニノバリコーム マナノンコー リーアノゼキい	
/. r	· リイハノノトリェノをインストールしてください。	
G	) 🧕 ドライバー ソフトウェアの更新 - USB_HX Driver	
	トライバー シントウエアをインストールしています	
	- Windows セキュリティ	
	このデバイス ソフトウェアをインストールしますか?	
	名則: libusb-win52 libusb-win52 devices 《一 発行元: 3S-Smart Software Solutions GmbH	
	"35-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(A)         インストールしない(Δ)	
	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(<u>A</u>)</li> <li>● 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアの</li> </ul>	
	<ul> <li>"3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(A)</li> <li>使信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアを 近する方法</li> </ul>	
	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(Δ)</li> <li>⑦ 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイスソフトウェアを 断する方法</li> </ul>	
	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(A)</li> <li>⑦ 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアを 近する方法</li> </ul>	
	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(Δ)</li> <li>⑦ 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアで 断する方法</li> </ul>	
	<ul> <li>"3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(A)</li> <li>使信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアで 近する方法</li> </ul>	
	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(点)</li> <li>⑦ 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアス 断する方法</li> </ul>	
	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(Δ)</li> <li>● 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイスソフトウェアで 近する方法</li> </ul>	
	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(点)</li> <li>⑦ 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアス 断する方法</li> </ul>	
	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(Δ)</li> <li>● 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアで 断する方法</li> </ul>	
	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(点)</li> <li>⑦ 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェア2 断する方法</li> </ul>	
2	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(Δ)</li> <li>④ 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアの 地する方法</li> </ul>	
2	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(Δ)</li> <li>● 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイスソフトウェアで 助する方法</li> </ul>	
2	<ul> <li>□ "3S-Smart Software Solutions GmbH" からの ソフトウェアを常に信頼する(Δ)</li> <li>⑦ 信頼する発行元からのドライバー ソフトウェアのみをインストールしてください。安全にインストールできるデバイス ソフトウェアの 地する方法</li> </ul>	

8. 正常に終了したらデバイスマネージャには、下記の様に表示されます。

〇〇 III ドライバー ソフトウェアの更新 - Lib Usb Device	<b>~</b>	
ドライバー ソフトウェアが正常に更新されました。		
このデバイスのドライバー ソフトウェアのインストールを終了しました:		
Lib Usb Device		
	閉じる( <u>C</u> )	
温 デバイス マネージャー	_ 0	
Ibusb-win32 devices		
▶ ▲ コンピューダー ▶ ▲ サウンド、ビデオ、およびゲーム コントローラー		
▶ - ● システム デバイス ▶ - ● セキュリティ デバイス		
<ul> <li>□ ディスク ドライブ</li> <li>▶ ■ ディスプレイ アダプター</li> </ul>		
▶ 🔮 ネットワーク アダプター ▶ 🖷 トューマン インターフェイス デバイス		
<ul> <li>□ → ☆ バート (COM 2 LPT)</li> <li>□ ♪ - ② マウスとそのほかのポインティング デバイス</li> </ul>		I NL
▶ ● モニター ▶ ● ユニバーサル シリアル バス コントローラー		
		1/1~
1.6		

9tive

entativo

## 1.2 Startup

[スタートメニュー]-[全てのプログラム]-[HX-CODESYS]-[HX-CODESYS V3.5 SP8 Patch 4]をクリックすると、 下記のスタートページが表示されます。

es	→ # × 🙀 Start Page 🗙		, ,
	HX-CODESYS V3.5 SP8 Patch	4	
	Basic Operations	Latest News	
	<ul> <li>New Project</li> <li>Open Project</li> <li>Open Project from PLC</li> </ul>	The current news channel might not be valid or your Internet connection might be unavailable. To chang news channel, go to the Options dialog and select the Load&Save category.	e the
	Recent Projects		
	Close page after project load		

Click icon or choose [File]-[New Project...] to create a new project file. Then New Project dialog box appears as below. Choose "Standard project", enter new file name, specify location and click [OK].

	管 New Proj	ect			×
	<u>C</u> ategories	:	Templates:		
		raries jects	Empty project	standard project	Standard project with Applicatio
	A project co	ontaining one device, one ap	plication, and an emp	ty implementation for I	PLC_PRG
	Name:	Untitled28			
	Location:	C:¥Users¥10145603.GLOB	AL¥Documents		▼
				ОК	Cancel
8	72	31	i		1-7

Choose CPU type and programming language and click [OK].

Available languages are as follows.

- Continuous Function Chart (CFC) •
- Function Block Diagram (FBD) .
- Instruction List (IL)
- Ladder Logic Diagram (LD)
- Sequential Function Chart (SFC)
- Structured Text (ST)

Standard	Project		×
1	You are about to cre objects within this p	ate a new standard project. This wizard will create the following project:	1
	- One programmable - A program PLC_PR - A cyclic task which - A reference to the r	a device as specified below G in the language specified below calls PLC_PRG newest version of the Standard library currently installed.	
	Device: HX-CP	P1H16 (Hitachi Industrial Equipment Systems Co., Ltd.)	-
	PLC_PRG in: Struct	tured Text (ST)	•

#### 以下のような画面が基本構成となります。

Untitled27 project - HX-GODESTS	-19	
Elle Edit View Project Build Online [	Zebug Iools Window Help	
🎦 📽 🖬 🞒 l い つ 🏅 陆 陆 🗙	桷 编  ab   木 匁 匁 斉   陶   陶 - C   幽   翎 ଓ → 🔤 ペ   ほ 注 性 谷   〃   🖶	
Devices 👻 🕂 🗙	PLC_PRG X	-
Untitled27	1 PROGRAM PLC_PRG	
BUDEVICE (HX-CP1H16)	2 VAR	
- O Application		
Library Manager		
= UKA Task Configuration		
🖃 😻 MainTask		
PLC_PRG		
Easic (Basic)		
<pre>K <empty> (<empty>)</empty></empty></pre>		
<pre>Empty&gt; (<empty>)</empty></pre>		
<pre>c <empty> (<empty>) C <empty> (<empty>)</empty></empty></empty></empty></pre>		
<pre>K <empty>(<empty>)</empty></empty></pre>		
<empty> (<empty>)</empty></empty>		
<pre>C <empty> (<empty>) C <empty> (<empty>)</empty></empty></empty></empty></pre>		
<pre>K <empty> (<empty>)</empty></empty></pre>		
<pre>C <empty> (<empty>)</empty></empty></pre>		
	Editor	
	Editor	
Device		
201100		
	Messages - Total 0 error(s), 0 warning(s), 0 message(s) 🗸 🗸	×
	C 0 error(s) 🔮 0 warning(s) 🔮 0 warssage(s) 🗙	
	Description Project Object Position	
	Messages	
	Last durid: 😳 U 🕐 U Precomplie: 🗸 Current user: (nobody) INS Ln 1 Col 1 Ch 1	

shidike

In the default setting, Device tree is behind the POU window. Click Devices tab to show it. "Toolbox" and Ative. "Properties" windows can be shown by [View] menu. ĬĬVE

## Chapter 2 Programming

#### 2.1 Plug Device (I/O configuration)

#### 2.1.1 Plug Device (I/O configuration)

Right click on < Empty> slot and choose "Plug Device...".



Choose I/O module for each slot. The next slot can be configured by clicking next empty slot <u>without</u> closing the Plug Device window every time.

'endor: Name	<all vendors=""></all>			
Name				
name		Vendor	Version	
🖃 🔐 M	iscellaneous			
- 11	16 Digital Input	Hitachi-IES	3.4.0.0	
··· 🗈	16 Digital Output	Hitachi-IES	3.4.0.0	
	32 Digital Input	Hitachi-IES	3.4.0.0	
	32 Digital Output	Hitachi-IES	3.4.0.0	
<b>(</b>	4 Analog Input	Hitachi-IES	3.4.0.0	
	64 Digital Input	Hitachi_TES	3400	
1919-1927 (1919)				
Display	y outdated versions			
Display	y outdated versions			
Display	y outdated versions n: Please select a devic	ce from the list a	above.	
Display	y outdated versions n: Please select a devic	ce from the list a	above.	
Display	y outdated versions in: Please select a devic	ce from the list a	above.	
Display	y outdated versions in: Please select a devia	ce from the list a	above.	
Display	y outdated versions in: Please select a devia	ce from the list a	above.	
Display	y outdated versions in: Please select a devia	ce from the list a	above.	

Module name can be renamed at "Properties" in right mouse click menu.

Tativ

lative

\_\_\_\_\_\_16\_Digital\_Output (16 Digital Output)

Shidive

Any\_Name (16 Digital Output)

Model names	Device Names	Slot position
	16 Digital input	No restriction
EH-AD0, AD10, ADL10		NO TESUTCUON
ЕП-ЛАІО, НІО ЕЦ УР22, УР122, УР226, УР1226	22 Disital insut	
EH-AD32, ADL32, AD32E, ADL32E,	32 Digital input	
	64 Digital input	
	64 Digital input	
EH-1R8B, 1R12, 1R10, 1R10D	16 Digital output	
Ен-ттра, ттрто, ттрто5		
	22 Di - ital sutmut	
ЕН-Ү 132, Ү 132Е, Ү 132Н	32 Digital output	
EH-Y1P32, Y1P32E		4
EH-Y164	64 Digital output	
EH-YTP64		-
EH-PT4	4 Analog input	-
EH-AX44, AX8V, AX8H, AX8I, AX8IO	8 Analog input	
EH-AXH8M		
EH-AXG5M *1		
EH-TC8		
EH-RTD8		
ЕН-АҮ22, АҮ2Н, АҮ4V, АҮ4Н, АҮ4І	8 Analog output	
*1		
EH-AYH8M		
EH-AYG4M *1		
EH-CU, CUE	EH-CU/E	
EH-POS	EH-POS/4	
EH-LNK, OLNK, OLNKE, OLNKG	EH-LNK	Only 0-7 slot on basic base
EH-RMP2	EH-LNK	*2
EH-FLN2, FLN3	EH-FLN2/3	

Although the number of channel is not 8, configure "8 ch. Analog". \*1

Phatike

\*2 If these module are mounted at 0-7 slot on basic bas, the errors blow are logged when download application to HX-CPU.

• In case of EH-LNK : EH-LNK is mounted on slot \*. Allowed position for EH-LNK is slot 0 to 7.

• In case of EH-FLN2/3 : EH-FLN2/3 is mounted on slot \*. Allowed position for EH-FLN2/3 is slot 0 to 7.

entative

#### 2.1.2 Scan For Devices

Instead of plugging I/O modules one by one, actual I/O module information can be read out from connected CPU. Right click on basic or expansion base and choose "Scan For Devices...". Then "Scan Devices" dialog appears. Click "Copy all devices to project". This function works for chosen base only. If you have several expansion bases, repeat "Scan For Device" for each base.

Devices			'q/j
Library Manager	Scan Devices		- 🗆 X
	Scanned Devices		
	Devicename	Devicetype	
Imain i ask	e	16 Digital Input	
···변] PLC_PRG		16 Digital Output	
Basic (B u	EH_LNK	EH-LNK (3.5.8.20) 🗸	
L CET	- EH_LNK	EH-LNK (3.5.8.20) 🗸	
Copy		<empty></empty>	
	<empty></empty>	<empty></empty>	
er Paste	<empty></empty>	<empty></empty>	
🤇 <er delete<="" td="" 🗙=""><td> <empty></empty></td><td><empty></empty></td><td></td></er>	<empty></empty>	<empty></empty>	
1 ×5		<empty></empty>	
Properties	<pre> <empty></empty></pre>	<empty></empty>	
	- CEmpty/	<empty <="" td=""><td></td></empty>	
🧲 <er add="" folder<="" td="" 🚞=""><td></td><td></td><td></td></er>			
K <er devices<="" for="" p="" scan=""></er>			
K <er device<="" disable="" p=""></er>			Show Differences to Project
Update Device	Scan Device		Copy All Devices to Project Close

#### Note

entative

Be sure to perform "Scan For Devices" after login and logout. "Scan For Devices" works only when logout however, gateway and active path must be set and opened once in advance.

3ntative

#### 2.1.3 Expansion unit

Instead of "Plug Device", choose "Add Device" to configure expansion units.

Devices	<b>→</b> 中 ×
Project	
B B PLC Lo &	Cut
	Сору
	Paste
-ī×	Delete
	Properties
***	Add Object +
Basic C	Add Folder
	Add Device
<u>ج</u> <	Update Device

Select "Expansion" under Miscellaneous. HX-CP1S08, HX-CP1H16 allows to expand up to 5 expansion bases.

EH-IOCH2 側にて設定するユニット No.は、CPU から近い方から Unit1 として順番に設定してください。

ALL N 2	
Name: Expansion 1	
Action:	
Append device C Insert device C Plug device C Update device	
Vendor: <all vendors=""></all>	
Name Vendor Version	
Expansion Hitachi-IES 3.4.4.0	
Group by category	
Display all versions (for experts only)     Display outdated versions	
Information:	
Name: Expansion	
Categories:	12
Append selected device as last child or Device	· · · · ·
(rod can select and the target node in the navigator while this whildow is     open.)	
Add Device Close	
2-4	

hative

l'ative

#### 2.1.4 Update Device

Although device (CPU) type is required to set when creating new project, it can be changed later. Right mouse click on the device and choose "Update Device". Then "Update Device" windows appears.



Select CPU type, and click "Update Device" button.

Indate Device	<b>V</b>	
I opuare bearce		
Name: Device		
Action:		
C Append device C Insert device C Plug device C Upda	ate device	
Device:		
Vendor: <a>All vendors&gt;</a>	•	
Name	Vendor 🔺	
	Hitachi-IES	
EHV-CPU1025	Hitachi-IES	
EHV-CPU1051	Hitachi-IES	
EHV-CPU1102	Hitachi-IES	
HX-CP1H16	Hitachi Industrial	
HX-CP1508	Hitachi Industrial	
Group by category		
Display all versions (for experts only)		
Display outdated versions		
	10	
Information:		
Name: HX-CP1H16		
Vendor: Hitachi Industrial Equipment Systems		
Co., Ltd.		
Categories: PLCs		
Update and try to preserve most information of		
Vou can select another target node in the navigator while	this window is	
open.)	chis whoow is	
Update Dev	vice Close	
2-5		

#### 2.1.5 I/O address

I/O addresses and variable names can be linked in two different ways: Global variable or Local variable as below.

#### [Global variable]

Double click on plugged I/O module or right click and choose "Edit Object".



I/O-Bus Mapping window appears as below. Input variable name at the mapping. These variables are used in the programming.

Digital Input 16 I/O Mapping	Channels						
	Variable	Mapping	Channel	Address	Туре	Unit	Descriptio
Information	<b>□</b> ¥≱			%IW0	WORD		
Status			Bit0	%IX0.0	BOOL		
	🍫		Bit1	%IX0.1	BOOL		
	···· 🍫		Bit2	%IX0.2	BOOL		
			Bit3	%IX0.3	BOOL		
	···· *>		Bit4	%IX0.4	BOOL		
	···· *>		Bit5	%IX0.5	BOOL		
	···· 🍫		Bit6	%IX0.6	BOOL		
	···· 🍬		Bit7	%IX0.7	BOOL		
	···· *>		Bit8	%IX1.0	BOOL		
	···· *>		Bit9	%IX1.1	BOOL		
	···· 🍬		Bit10	%IX1.2	BOOL		
	···· *>		Bit11	%IX1.3	BOOL		
	···· *>		Bit12	%IX1.4	BOOL		
	···· *>		Bit13	%IX1.5	BOOL		
	···· *>		Bit14	%IX1.6	BOOL		
		J	Bit15	%IX1.7	BOOL		

#### Note

lative

Available characters for variable names are only alphabet a to z, A to Z and number 0 to 9 and \_ (underscore). The first character must not be numeric characters. Several words like BOOL, WORD, IF, FOR etc. are reserved.

lativ,

entative

VE

Input any variable names in the field "Variable" according to your system.

Test_input_0	
Test_input_1 🍫 Bit1 %IX0.1 BOOL	
Bit2 %IX0.2 BOOL	

\_16\_Digital\_Input

Digital Input 16 I/O Mapping	Channels						
	Variable	Mapping	Channel	Address	Туре	Unit	Description
Information	⊟ <b>*</b> ≱			%IW0	WORD		
Status	Test_input_0	**	Bit0	%IX0.0	BOOL		
	🍫 Test_input_1	*	Bit1	%IX0.1	BOOL		
	···· 🍫 Test_input_2	***	Bit2	%IX0.2	BOOL		
	- * Test_input_3	**	Bit3	%IX0.3	BOOL		
	🍫 Test_input_4	***	Bit4	%IX0.4	BOOL		
	🍫 Test_input_5	***	Bit5	%IX0.5	BOOL		
	🍫 Test_input_6	***	Bit6	%IX0.6	BOOL		
	🍫 Test_input_7	***	Bit7	%IX0.7	BOOL		
	🍫 Test_input_8	***	Bit8	%IX1.0	BOOL		
	🍫 Test_input_9	***	Bit9	%IX1.1	BOOL		
	🍫 Test_input_10	***	Bit10	%IX1.2	BOOL		
	🏷 Test_input_11	***	Bit11	%IX1.3	BOOL		
	- 🍽 Test_input_12	***	Bit12	%IX1.4	BOOL		
	🍫 Test_input_13	**	Bit13	%IX1.5	BOOL		
	🏷 Test_input_14	**	Bit14	%IX1.6	BOOL		
	Test_input_15	*	Bit15	%IX1.7	BOOL		

After defining variable names, they will be automatically listed up when it is used in all POU with assist of auto-complete that are displayed in case of selecting "List components immediately when typing".



If a variable is already used (declared) in POU or global variable list, it can be taken by clicking .... icon in I/O mapping window. (.... icon appears by clicking empty field.)

···· 🔶	Application.GVL.EMG_STOP	<b>~</b>	BitO
··· 🔌	Application.PLC_PRG.test_out	<b>~</b>	Bit1
			2-7

#### [Local variable]

Local variables are defined in each POU and valid only in the POU.

If new variable name is used in the first time, Auto Declare window will appear as below. In this window, there is an input field "Address". Enter I/O address in this field according to data types. If it is remained as blank, the variable will be mapped in memory area.

	Auto Declare			×		
	Scope: VAR  Object:  PLC_PRG [Application]  Elags:  CONSTANT  RETAIN  PERSISTENT	Name: test_input_0 Initialization: Comment:	Type: BOOL Address: %IX1.0			
			ОК	Cancel		
	After clicking [OK] button, dec PLC_PRG POU X PROGRAM FLC_PRG VAR tesy_input_0 AT test_output_0 A END_VAR	* %IX1.0: BOOL; T %QX1.0: BOOL;	d automatically as be	low.		
-	Project project - HX-CODESYS  File Edit View Project FBD/LD/L Build Online Debu  Contracts  Contra	Dols Window Help 111 ・ ①   一 ( ○ ○ → ■ ↓ ( □ □ 1 111 ・ ①   一 ○ ○ ↓ □ ○ ↓ ( □ □ 1 112 ・ ①   □ ○ ↓ ( □ □ 1 112 ・ ①   □ □ ↓ ( □ □ 1 112 ・ ①   □ □ ↓ ( □ □ 1 112 ・ ①   □ □ ↓ ( □ □ 1 112 ・ ①   □ □ ↓ ( □ □ 1 112 ・ ①   □ □ ↓ ( □ □ 1 112 ・ ①   □ □ ↓ ( □ □ 1 112 ・ ①   □ □ ↓ ( □ □ 1 112 ・ ①   □ □ ↓ ( □ □ 1 112 ・ ①   □ □ ↓ ( □ 1 112 • ① ↓ ( □ 1) ↓ ( □ 1) ↓ ( □ 112 • ① ↓ ( □ 1) ↓ ( □	한재왕(수)를 전환경	TooBox - General F Network		
	Application     GVL     G	tesy_input_0 AT %IXI.0: BOOL; test_output_0 AT %QXI.0: BOOL; ND_VAR tesy_input_0	Declaration field	■ Box with EN/E ■ Box with EN/E ■ Main Box with EN/E ■ Main Assignment → Jump • With EN/E ■ Main Assignment ↓ Input	NO	
	€ <empty> (<empty>)         C       <empty> (<empty>)         E       <empty> (<empty>)         E       <empty> (<empty>)</empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty></empty>			+ Function blocks - Ladder elements - Ladder elements - Ladder elements - Parallel contact - Paralle	act ct ed contac	
	Massanes - Total 1 error(c) 0 warning(c) 4 merezga(c)		<b>k</b> + Q	100 % 🕅 T Branch Branch Start/i		
		Ţ	Last build: 😋 0 🕐 0 🛛 Precompile: 🧲	Current user: (nobody)		
		<b>8</b> >	2 – 8			

		Permis component					
Bit number	BOOL	BYTE	WORD	DWORD	LWORD		
Bit 0	%QX0.0		%QW0	%QD0	%QL0	LSB	1
Bit 1	%OX0.1	1					
Bit 2	%OX0.2	1				1	
Bit 3	%0X03	1					
Bit 4	%OX04	1					
Bit 5	%0X0.5	1					_
Bit 6	%0X0.6	1					
Bit 7	% OX0 7	-					
Bit 9	% OV1 0	%OP1	-				
Bit 0	70 QAI.0	- 70 QB1					
DIL 9 Dit 10	%QA1.1						
Dit 10	%QA1.2						
BIUII Div 10	%QX1.3						
Bit 12	%QX1.4	-					
Bit 13	%QX1.5	-					
Bit 14	%QX1.6	-		-			
Bit 15	%QX1.7						
Bit 16	%QX2.0	_ %QB2	%QW1				
Bit 17	%QX2.1	4					
Bit 18	%QX2.2	4					
Bit 19	%QX2.3	4					
Bit 20	%QX2.4	4					
Bit 21	%QX2.5	_					
Bit 22	%QX2.6						
Bit 23	%QX2.7						
Bit 24	%QX3.0	%QB3					
Bit 25	%QX3.1						
Bit 26	%QX3.2						
Bit 27	%QX3.3						
Bit 28	%QX3.4						
Bit 29	%QX3.5						
Bit 30	%QX3.6	1					
Bit 31	%QX3.7	1					
Bit 32	%QX4.0	%QB4	%QW2	%QD1			
		1					
Bit 39	%OX4.7	1					
Bit 40	%OX5.0	%OB5	1				
Bit 47	%OX5.7	1					
Bit 48	%OX6.0	%OB6	%OW3	1			
	10 211010						
Bit 55	%0X67						
Bit 56	%0X70	%0B7					
						MOD	
Bit 63	%0X77					MSB	
Bit 63	%QX7.7					MSD	<b>``</b>
Following 5 d	lifferent codes a	access the same b	oit.				
%∩X∩ ∩·=1	•	in suite suite t					
	,						
%QB0 :=1;	;						
%QW0 :=1;	;						
%QD0 :=1;	;						
%QL0 :=1;	;						
~ ~ ~							
		,					
	7 6.						
			2 – 9	I			

I/O address example of 64 points output module

#### Note

If you use the application of EHV+ series to HX series, be noted that direct IEC address data is swapped. In case of using variable name, data is not swapped.

The deference of I/O address of 64 points output module between EHV+ series and HX series.

<u> </u>											
	EHV+ ser	ies IEC add	ress			HX series	IEC adress				
Bit	BOOL	BYTE	WORD	DWORD	LWORD	BOOL	BYTE	WORD	DWORD	LWORD	
Bit 0	%QX7.0	%QB7	%QW3	%QD1	%QL0	%QX0.0	%QB0	%QW0	%QD0	%QL0	
Bit 1	%QX7.1					%QX0.1					
Bit 2	%QX7.2					%QX0.2					
Bit 3	%QX7.3					%QX0.3					
Bit 4	%QX7.4					%QX0.4					
Bit 5	%QX7.5					%QX0.5					
Bit 6	%QX7.6					%QX0.6					
Bit 7	%QX7.7					%QX0.7					
Bit 8	%QX6.0	%QB6				%QX1.0	%QB1				
Bit 9	%QX6.1					%QX1.1					
Bit 10	%QX6.2					%QX1.2					
Bit 11	%QX6.3					%QX1.3					
Bit 12	%QX6.4					%QX1.4					
Bit 13	%QX6.5					%QX1.5					
Bit 14	%QX6.6					%QX1.6					
Bit 15	%QX6.7					%QX1.7					
Bit 16	%QX5.0	%QB5	%QW2			%QX2.0	%QB2	%QW1			
Bit 17	%QX5.1					%QX2.1					
Bit 18	%OX5.2					%QX2.2					
Bit 19	%OX5.3					%QX2.3					
Bit 20	%OX5.4					%QX2.4					
Bit 21	%OX5.5					%QX2.5					
Bit 22	%OX5.6					%QX2.6					
Bit 23	%OX5.7					%QX2.7					
Bit 24	%OX4.0	%QB4				%QX3.0	%QB3				
Bit 25	%OX4.1					%QX3.1					
Bit 26	%OX4.2					%QX3.2					
Bit 27	%OX4.3					%QX3.3					
Bit 28	%OX4.4					%QX3.4					
Bit 29	%OX4.5					%QX3.5					
Bit 30	%OX4.6					%QX3.6					
Bit 31	%OX4.7					%QX3.7					
Bit 32	%QX3.0	%QB3	%QW1	%QD0		%QX4.0	%QB4	%QW2	%QD1		
Bit 39	%QX3.7					%QX4.7					
Bit 40	%QX2.0	%QB2				%QX5.0	%QB5				
		]					]				
Bit 47	%QX2.7	1				%QX5.7					
Bit 48	%QX1.0	%QB1	%QW0	1		%QX6.0	%QB6	%QW3	1		
		]					Y				
Bit 55	%QX1.7					%QX6.7					
Bit 56	%QX0.0	%QB0				%QX7.0	%QB7				
		1 -									
Bit 63	%QX0.7					%QX7.7					

aive

#### 2.2 I/O-update

Input data is read at the beginning of a task and output data is written at the end of a task. I/O-update settings are configured in "PLC settings" in Device tab. Be noted that only used I/Os in program are updated, Not used I/Os are updated.

Device X				
Communication Settings	Application for I/O handli	ng: Application		
Applications	PLC settings			
Backup and Restore	Behaviour for outputs in	stop: Keep current values		
Files	Always up date variables	Disabled (update only if used in a	task)	
Log	Edit Licenses			
PLC settings	Bus cycle options Bus cycle task:	<unspecified></unspecified>		
PLC shell	Addtional settings			
Users and Groups	Generate force variab	les for IO mapping 🔲 Enable Diagnos	sisfor devices	
PLC Parameters	L Show I/O warnings as	errors		

#### Update IO while in STOP

If this option is activated (default), the values of the input and output channels get also updated when the PLC is stopped.

#### Behaviour for outputs in STOP

Keep current values: The current values will not be modified. If "Update IO while is stop" is deactivated, output data is not updated at CPU stopping.

Set all outputs to default: The default values resulting from the mapping will be assigned. If this setting is used, "Reset all outputs in STOP" of [Device]-[Configurtion] parameter must be set as "No", otherwise default value of TRUE is not valid. Refer to the next page for further information.

**Execute program**: You might determine the outputs behaviour by a program available within the project. Enter the name of this program here and it will be executed when the PLC gets stopped. Via button [...] the input Assistant can be used for this purpose.

#### Always update variables:

If this option is activated, then for all devices of the current PLC configuration all I/O variables will get updated in each cycle of the bus cycle task. This corresponds to option "Always update variables", which can be set separately for each device in the "I/O Mapping" dialog.

#### Note

If all the following conditions are fulfilled and reset warm/cold is operated, the last status of output module remains although monitored output status is reset.

- Update IO while in stop in PLC settings: Disabled
- Behavior for outputs in Stop in PLC settings: Keep current values
- Reset all outputs in STOP in Device Configuration: No
- Variable of output module is mapped to existing variable that declared in POU or GVL.

#### PLC settings

test

#### Update IO while in stop

Behaviour for outputs in Stop Keep current values Actual output remains after Reset warm/cold



-670)



This is expected behavior. If this setting combination is required, keep in mind this mismatching and be careful to use.

#### Reset all outputs in STOP

This setting is in [Device]-[Configuration]. If "Reset all outputs in STOP" is "Yes" (default), all the PLC outputs including counter outputs and pulse train output of positioning module are reset because it is reset by a certain hardware signal running on the back plane bus. If default value in configured as TRUE in I/O mapping table, it is momentary reset (FALSE) at run or stop timing. If default values should be kept, set "Reset all outputs in STOP" as "No." In this case, you must be aware following limitation.

#### Note

プログラムで使用していない I/O はリフレッシュされません。従って、例えば使用していない外部入力を ON してもオンライン中にマッピングテーブルをモニタした時に TRUE に見えません。マッピングテ 右下の「常に変数を更新」を有効にすると、使用/未使用に関わらずリフレッシュされます。

gital Input 16 I/O Mapping	Channels										
	Variable	Mapping	Channel	Address	Туре	Current Value	Prepared Value				
nation	⊟¥≱			%IW0	WORD						
us	ᡟ Test_input_0	*	Bit0	%IX0.0	BOOL	FALSE					
	ᡟ Tes_inout_1	*	Bit1	%IX0.1	BOOL						
	* Tes_inout_2	*	Bit2	%IX0.2	BOOL						
	- * Tes_inout_3	**	Bit3	%IX0.3	BOOL						
	ᡟ Tes_Inout_4	***	Bit4	%IX0.4	BOOL						
	* Tes_inout_5	***	Bit5	%IX0.5	BOOL						
	🏷 Tes_inout_6	***	Bit6	%IX0.6	BOOL						
	🏷 Tes_inout_7	***	Bit7	%IX0.7	BOOL						
	🏷 Tes_inout_8	***	Bit8	%IX1.0	BOOL						
	🏷 Tes_inout_9	***	Bit9	%IX1.1	BOOL						
	🏷 Tes_inout_10	***	Bit10	%IX1.2	BOOL						
	🏷 Tes_inout_11	***	Bit11	%IX1.3	BOOL						
	Tes_inout_12	***	Bit12	%IX1.4	BOOL						
	Tes_inout_13	***	Bit13	%IX1.5	BOOL						
	Tes_inout_14	***	Bit14	%IX1.6	BOOL			<b>E</b> al la d		113	
	** Tes_inout_15	***	Bit15	%IX1.7	BOOL			Enabled	d 2 (always in bus cycle	task)	
	* * Tes_inout_13 ** Tes_inout_14 ** Tes_inout_15	×	Bit13 Bit14 Bit15	%IX1.5 %IX1.6 %IX1.7	BOOL BOOL BOOL	FALSE FALSE FALSE	,	Enabled	d 2 (always in bus cycle	task)	
	Reset	manning	Alwaye unda	te variables	Enabled 2 (a	wave in hue cycle tae	N -				
	it.				en abreu 2 (d	mays in ous cycle tas	~y ~				
	🍫 = Create new variable	~ <b>∲</b> = M	ap to existing	variable							
	パスサイクルオプション パスサイクルタスク Use par	ent bus cycle se	etting v								
	Γ										

#### Note

If "Reset all outputs in STOP" is "No", PLC outputs without IEC address, such as counter outputs or pulse train outputs, are NOT reset when CPU stops. We recommend you to set "Yes" when using counter or positioning modules.

nunication Settings	Parameter	Туре	Value	Default Value
	💷 🗇 🔁 LAN			
cations				
	🕸 📴 FTP			
p and Restore	Stop switch definition	Enumeration of BYTE	Reset warm	Reset warm
	Reset all outputs in STOP	Enumeration of BYTE	Yes	Yes
iles	Battery error detection	Enumeration of BYTE	Enable	Enable
	I/O config error detection	Enumeration of BYTE	Enable	Enable
	Program up/download by USB memory	Enumeration of BYTE	Disable	Disable
ittings iell				

#### Note

TVF

If "Reset all outputs in STOP" is "Yes" (default), default value of "TRUE" in I/O mapping table is momentary reset (FALSE) at run or stop timing.

shative

#### 2.3 POU and task

One application has at least one POU and one task as shown below.



#### POU

POU stands for Program Organization Unit. This can be assumed as a paper to create your program. Only one programming language can be used in one POU. If you need another language, add POU by right click on "Application" and choose "Add object"-"POU" and choose language.



#### Task

POU does not have information how it is executed. This information is handled by task.

Put priority, choose type of task and add or remove POU accordingly.

	Configuration
PLC_PRG (PRG) Configuration POU (PRG) Configuration MainTask PLC_PRG	Priority ( 031 ): 1 Type Cyclic Interval (e.g. t#200 Watchdog Enable Add POU Time (e.g. t#200ms): Remove POU Sensitivity: 1 Add Call Remove Call Change Call POU POU

#### Priority (0-31)

0 is the highest priority, 31 is the lowest.

#### Type

#### Cyclic task

The task will be processed cyclic according to the time definition given in the field "Interval".

#### **Event task**

The task will be started as soon as the variable defined in the field gets a rising edge.

#### **Freewheeling task**

The task will be processed as soon as the program is started and at the end of one run will automatically restarted in a continuous loop. There is no cycle time defined. Be noted that the priority of this task is the lowest and 100ms of sleeping time is added at the end of each cycle for other tasks to be executed properly.

#### Status task

The task will be started when selected variable is TRUE.

#### Watchdog

When it is enabled, watchdog function is activated. If program execution time exceeds watchdog time, CPU stops program execution with "24" error code displayed at 7 segment LED.

Example: In case of "Time:#5ms" and "Sensitivity:10, there are two detect conditions as below.

- Detect condition 1 : over 10 times continuously
- Detect condition 2 : over 50ms  $(5ms \times 10)$

Actual cycle time of each task is monitored in Task configuration as below.

Task	Status	IEC-Cycle Count	Cycle Count	Last Cycle Time (µs)	Average Cycle Time (µs)	Max. Cycle Time (µs)	Min. Cycle Time (µs)	Jitter
A MainTask								
Ш.,	_							
				2 1	4			

Phatike

### 2.4 Available characters for variable names

Available characters for variable names are only alphabet a to z, A to Z and number 0 to 9 and \_ (underscore). The first character must not be numeric characters. Several words like BOOL, WORD, IF, FOR etc. are reserved.

#### Supported characters

Types	Supported	Remarks
Numerical	0 to 9	Not allowed to begin with numeric characters.
Alphabetical	a to z, A to Z	
Symbol		Trailing underscores are not allowed.

#### Examples for variable names

Allowed or not	Examples	Descriptions
Allowed	Test_200	S C S
	TEST	
	Test55	
	_Test	
Not allowed	2test	Starting with numeric character.
	test200	Trailing underscores are not allowed
	test-5	Minus sign is not allowed.
	test#3	other signs than underscore are not allowed.
	test 3	Space is not allowed.
4	IF	Reserved word.

#### 注意

entative

Warning message is displayed at the points that the Unicode characters are not allowed.



If you use unicode characters, click "Project"-"Project setting", and check "Allow unicode characters for identifiers" in "Compile option".



VR

#### 2.5 Variables

#### 2.5.1 Data memory

In HX-CODESYS programming, external I/Os and data memory (internal registers) are handled as variable names instead of direct I/O addresses, such like "A1\_switch". If new variable name is used, below Auto Declare window appears. Enter an each field according to following table.

cope.	Name:	<u>I</u> ype:
AR	var1	INT
bject:	Initialization:	<u>A</u> ddress:
LC_PRG [Application]	•	
Jags:	Comment:	
CONSTANT RETAIN		
PERSISTENT		

Item		Descriptions		
Scope		Choose "VAR" in normal use. If global variable is used, choose "VAR_GLOBAL".		
		Refer to section 3.6.7 for further information.		
Name Variable name is defined. (available characters are described in section 3.6.3.		Variable name is defined. (available characters are described in section 3.6.3.		
Туре	TypeData type is defined. Refer to section 3.6.5 Data type.			
Object In case of local variable, POU name is defined.		In case of local variable, POU name is defined.		
Initialization Initial value when program starting ca		Initial value when program starting can be set here. If it's blank, initialization value is 0.		
Address	3	No need to enter I/O address. EHV-CODESYS will assign to free address automatically.		
Comme	ent	Any text comment can be input.		
Flags	CONSTANT	Enter a value in the Initialization field.		
	RETAIN	The value is maintained by a battery after switch off of the PLC. If new application is		
		downloaded, it will be initialized. (Refer to the section 3.13)		
	PERSISTENT	The value is maintained by a battery after switch off of the PLC. If new application is		
		downloaded, it will be maintained. (Refer to the section 3.13)		

#### Bit access

Any bit data in integer type data can be accessed by adding suffix dot and number (decimal 0 to 63).



Login display	
wTest 16#0005 :=5;	
wTest 16#0005 .0 TRUE;	
wTest 16#0005 .1 FALSE ;	
wTest 16#0005 .2 TRUE;	
wTest 16#0005 .3 FALSE ;	

#### 2.5.2 Maker memory

Normally users do not have to take care about internal address of data memory however, if needed, the marker memory is useful. The address of marker memory is %M.

(AD	Name:	<u>Iype:</u>	चरा
bject:	Initialization:	<u>A</u> ddress:	i_
PLC_PRG [Application]		%MD10	
lags: CONSTANT RETAIN PERSISTENT	Co <u>m</u> ment:		×

For example, DWORD data dwTest, WORD data wTest\_H and wTest\_L are declared in the address %MD10, %MW20 and %MW21. Then high word and low word can be accessed separately with using %M addresses. The relation between each data types are same as page 3-14. Just replace "Q" with "M". The marker memory does not support RETAIN nor PERSISTENT flags.

Variable declaration

```
VAR
```

```
dwTest AT %MD10: DWORD;
wTest L AT %MW20:
                    WORD:
wTest_H AT %MW21: WORD;
```

#### END VAR

#### Login display

wTest_H AT %	MW21: WORD;				
END_VAR					
Expression	Туре	Value	Prepared value	Address	
ø dwTest	DWORD	16#12345678		%MD10	
WTest_L	WORD	16#5678		%MW20	
🔷 wTest_H	WORD	16#1234		%MW21	

The max. size of marker memory is 48KB. Supported address range is shown below.

	Data type	Address range
	BOOL	%MX0.0 ~ %MX49152.7
	BYTE	%MB0 ~ %MB49152
	WORD	%MW0 $\sim$ %MW24575
$\mathbf{A}$ ,	DWORD	%MD0 $\sim$ %MD12287
	LWORD	%ML0 $\sim$ %ML6143
		2 – 18

entativ,

15

#### 2.5.3 Numeric literals

Numeric literals are specified as follows.

Types	Examples	Remarks
Integer	-12 0 123_456 +986 10#1234	Underscore is ignored
Real	-12.0 0.0 0.4560 3.14159_26	Underscore is ignored
Real with exponents	-1.34E-12 1.0E+6 1.23E6	
Base 2	2#1111_1111 2#1110_0000	Underscore is ignored
Base 8	8#377 8#340	
Base 16	16#FF 16#ff 16#1234_ABCD	Underscore is ignored
Boolean zero and one	0 1 FALSE TRUE	FALSE=0, TRUE=1
Time	T#100ms, T#5.5s	Timer (TON, etc.)
Date	DT#2012-12-31-12:34:56	RTC (Realtime clock)

#### 2.5.4 Data types

No.	Data types	Name	Size	Range
1	BOOL	Boolean	1	0 or 1
2	SINT	Short integer	8	-128 to 127
3	USINT	Unsigned short integer	8	0 to 255
4	BYTE	Bit string of length 8	8	0 to 255 (16#00 to 16#FF)
5	INT	Integer	16	-32,768 to 32,767
6	UINT	Unsigned integer	16	0 to 65,535
7	WORD	Bit string of length 16	16	0 to 65,535 (16#00 to 16#FFFF)
8	DINT	Double integer	32	-2,147,483,648 to 2,147,483,647
9	UDINT	Unsigned double integer	32	0 to 4,294,967,295
10	DWORD	Bit string of length 32	32	0 to 4,294,967,295 (16#00 to 16#FFFFFFFF)
11	REAL	Real numbers	32	±1.175494351 E-38 to 3.402823466E+38
12	TIME	Duration	32	0 to 4,294,967,295 ms Unit : "d": days, "h": hours, "m": minutes, "s": seconds, "ms": milliseconds Ex. T#100S12ms, t#0.1s
13	LREAL	Long reals	64	±1.7976931348623 E+308 to 2.2250738585072 E-308
14	STRING	Variable-length single-byte character string	8× n	1 to 255 char.
15	LINT	Long integer	64	$-2^{63} \sim 2^{63}$ -1
16	ULINT	Unsigned long integer	64	$0 \text{ to } 2^{64}$ -1
17	LWORD	Bit string of length 64	64	$0 \text{ to } 2^{64}$ -1
18	DATE	Date	32	year-month-day Ex. DATE#1996-05-06 d#1972-03-29
19	DATE_AND_TIME	Date and time of Day	32	year-month-day-hour:minute:second Ex. DATE_AND_TIME#1996-05-06-15:36:30 dt#1972-03-29-00:00:00
20	TIME_OF_DAY	Time of day	32	<pre>hour:minute:second Ex. TIME_OF_DAY#15:36:30.123 tod#00:00:00</pre>
21	LTIME	Long duration	64	Unit :"us": microseconds, "ns": nanoseconds Ex. LTIME#1000d15h23m12s34ms2us44ns
22	WSTRING	Variable-length double-byte character string	16× n	
23	ARRAY	Аттау	_	<pre>Ex. in variable declaration test: ARRAY[0100] OF WORD; in user program test[5]:=20;</pre>
#### 2.5.5 Local variable

entative

If new variable name is used in POU, Auto Declare window appears as below. If the field "Address" is remained as empty, this variable will be assigned in a certain memory area of CPU.

		Tibe.	19 19	
'AR	test_input	BOOL		
bject:	Initialization:	<u>A</u> ddress:		
LC_PRG [Application]				
lags:	Comment:			
			<u>~</u>	
PERSISTENT			*	
<u>R</u> ETAIN PERSISTENT			<b>T</b>	

Click [OK] button, this variable is registered in declaration part of POU as below.



This variable is valid only in the POU. Even if same variable name is used in another POU, Auto Declare window will appear and it will be assigned in another memory location and handled as different variable.

tative

Tentative

#### 2.5.6 Global variable

If variables need to be commonly used in all POUs, "Global Variable List" must be created by right click on Application as below.



If new variable name is used in POU, Auto Declare window appears as shown in local variables. Choose "VAR\_GLOBAL" at "Scope" as below.

Scope:	Auto Declare		×
VAR	Scope:	▼ Name:	Type:
None VAR VAR_INPUT VAR_OUTPUT VAR_IN_OUT VAR_TEMP VAR_STAT VAR_GLOBAL	Object: PLC_PRG [Application] Elags: CONSTANT RETAIN PERSISTENT	Initialization:	Address:
10			OK Cancel

New variable name "test\_input2" is registered in GVL as below instead of POU.



## 2.6 Configuration

Open device window and set CPU's parameters in Configuration tab.

Paramete	r	Description					
LAN/	IP Address						
ETH1,	Subnet Mask	When requesting	to change the Ethernet port related parameters, be sure to				
ETH2,	Ethernet port Link speed /	set "Yes" in "Cl	hange IP information", otherwise parameters are not				
ETH3	Duplex mode	downloaded. Do not forget to set back to "No" after downloading.					
Default Ga	iteway						
Change IP	information	Yes	IP information is downloaded together with				
_			application.				
		No (default)	IP information is not downloaded when application				
			downloading.				
NTP	NTP function	Enable /	Setting Use(Enable) calendar clock from NTP server				
		Disable (default)	or not(Disable)				
	Port number	ETH1 / ETH2 /	Cotting and the day shade				
		ETH3	Setting port used calendar clock				
	Logical port number	123					
	Specified by	IP address					
	The second se	(default) /	Setting how to set NTP server				
		Host name					
	IP address or Host name	Setting IP address	or host name				
	Access cycle	Setting access cyc	le to NTP server				
	Timeout	Setting timeout time					
	TimeZone	Setting time zone					
FTP	FTP server						
	Port number	Setting parameters regarding FTP server Refer to page 2.19					
	Access Media						
	User Name						
	Password						
Stop switch	h definition	Reset warm	When Run/stop switch is changed from run to stop,				
		(default)	"Reset warm" operation is performed.				
		Stop	When Run/stop switch is changed from run to stop,				
		ыор	"Stop" operation is performed.				
Serial port	term. resistor	No (default)	終端抵抗なし				
(RS-485)		Yes	[1]TX+, [3]RX+ と[2]TX-, [4]RX-端子間に終				
		105	端抵抗 120Ω				
Reset all or	utputs in STOP	Yes	all outputs are reset by hardware signal on the				
		(default)	backplane when switching to stop mode. (Refer to				
		(defudit)	page 3-16)				
		No	all outputs are controlled by IEC program				
Dattama	an datastian		(software)				
Battery err	or detection	Enable (default)	Detect battery error				
		Disable	Not detect battery error				
I/O config	error detection	Enable (default)	Detect I/O configuration error				
		Disable	Not I/O configuration eoor				
Program u	p/download by USB memorv		USB メモリによるプログラムのアップロード/				
		Enable /	ダウンロード機能を有効にするか(Enable)、し				
		Disable (default)	ないか(Disable)を設定します。				

#### Note

-ETH1,2,3の IP Address ヘネットワークアドレスの入力が可能ですが、設定不可となります。(例:10.0.0.) この場合、ログに設定できない旨のエラーが表示されます。

-ETH1,2,3 の Subnet Mask へ不正なサブネットマスクの入力が可能ですが、設定不可となります。(例:

		Chapter 2 Programming
255.255. <u>254</u> .0) C	り場合、ロクに設定できない旨のエフーか表 <sup>。</sup>	示されます。

ative Tentative Tentat

## 2.7 Communication settings

## 設定方法

#### How to configure

Double click on "Device (HX-CPxxxx)" or right click and choose "Edit Object".



"Device" window will appear as below. Choose "Communication Settings" tab and click "Scan network".

ative



Scan network を行った際に、複数のノードが検索される場合があります。

Ŧ	バイスの選択	5	
	コントローラへの	のネットワーク パスの選択:	
	🖃 - 💑 🖕 Gat	teway-4	
	··· 👔	HX-CPU [00DA.B001]	
		HX-CPU [00DA.B002]	

この場合は、ノードを選択した状態で[Wink]ボタンをクリックすると、そのノードの RUN ランプが 点滅します。CPU が STOP 状態の場合 2 回点滅します。CPU が RUN 状態の場合 3 回点滅します。

#### 注意

スタートページの「PLC からプロジェクトを開く...」よりデバイスを検索した際は、[Wink]ボタンにより点滅しません。

接続したい CPU をクリックしてから[OK」ボタンをクリックすると、接続対象に指定されます。 これで通信の設定は完了です。

通信設定	Scan network Gateway - De	vice 👻			
アプリケーション					
Backup and Restore					
7 <b>ต</b> 1ル				•	
ログ	G	ゲートウェイ ateway_1	-	[0002] (アクティブ)]	
PLC設定	IP	-Address:	Ţ	デバイス名:	
PLCシェル	Po	cainost irt:		HX-CPU デバイスアドレス:	
ユーザとグループ	12	17		0002	
PLC Parameters			7	ターケット ID: 1070 0009	
Task deployment	UPU 機種 HX-CP1S08	<u>ターケットD</u> 16#10700008	-	ターゲット タイプ: 4096	
Status	HX-CP1H16	16#10700009		ターゲット製造元: Hitachi Industrial Equipment Systems Co., Ltd.	
Information	HX-CP1H16S HX-CP1H16R	16#10700010 16#10700011	_	ターゲットのバージョン: 3.5.8.0	

接続対象に指定後は、「Device」メニューの「Rename Active Device...」をクリックすると、デバイス名を変 更することが出来ます。

Scan network Gateway 👻	Dev	ice 🔻					
		Add current device to favorites		_			
		Manage favorite devices	L	E	デバイス名の変	更	
		Rename active device			デバイス名		
		Send echo service			現在: 新:	HX-CPU	
	~	Store communication settings in project					
		Confirmed online mode					
	~	Filter network scans by target ID					

#### 注意

CPUとPC間がイーサネットケーブル、USBケーブルすべてで接続されていたとしても、「ネットワークスキャン」では最も早く検索された通信種別ひとつだけしか表示されません。また、「フィルタ」を「ターゲットID」から「なし」に変更すると、ネットワーク上のすべてのデバイスが検索されます。

# 2.8 Programming

#### Ladder programming

Basic ladder programming is shown below as a first step. irther information about programming.

Several ways are available to add contact or coil to POU as

#### Contact

- Drag from ToolBox to [Start here].
- Menu [FBD/LD/IL]-[Insert Contact]
- Right mouse click [Insert Contact]
- Shortcut key [Ctrl + K]

#### Coil

- Drag from ToolBox to [Add output or jump here].
- Menu [FBD/LD/IL]-[Insert Coil]
- Right mouse click [Insert Coil]
- Shortcut key [Ctrl + A]

tan Plassa rafar to online halp of	EUV CODESVS for furth
tep. Flease feler to online-help of	ERV-CODES IS IOI IUIUI
	ToolBox
	General
U as below.	Boolean Operators
	Math operators
Start here	Other Operators
	Function blocks
	Ladder elements
222	ᢪ Network
	- Contact
	Negated contact
	🛿 🗗 Parallel contact
	411 Parallel negated contact
	< > Coil
Add output or jump here	
2.2.2	

Auto Declare		
Scope: VAR	<u>N</u> ame: test_input	Iype: BOOL
Object: PLC_PRG [Application]	Initialization:	<u>A</u> ddress:
Elags: Constant Retain Ersistent	Comment:	<u> </u>
		OK Cancel

If new variable name is used, Auto Declare window appears automatically. Edit each input field and check-boxes if necessary, and Click [OK]. The variable is declared in declaration window as below.

	PLC	PRG	<b>→</b> X
	1	PROGRAM PLC_PRG	▲ <u></u>
	2	VAR	
	3	test_input: BOOL;	ž
	4	test_output: BOOL;	<u> </u>
	5	END_VAR	-
•			
	1	test_input	test_output ()
			4(1)

#### Parallel contact across several contacts

Click several contacts with shift key and choose [Insert Contact Parallel] in right-mouse click menu or press [Ctrl + R] key.



Prativ

# 2.9 Login / Logout

#### Login

After programming, click or choose [Build] in Build menu. If compiling fails, error information is shown at "Description" field as follows. Double click the message to jump to the part to be corrected.

メッセージ - 合計 1 エラー, 1 警告, 0 メッセージ							
Build - O 1 エラー 😗 1 警告 😗 0 メッセージ 🗙							
説明			プロジェクト	オブジェクト	位置		
Build started: Application: HX_CP1H16.Application							
typify code							
◎ 既存の変数Application.POU.testは複数の入力をマッピン	/グされています!		Untitled 1	_16_Digital_Inp			
Compile complete 1 errors, 1 warnings							

### Note

If unknown message appears, it is recommended to [Clean all] in Build menu. All compile information is deleted by this operation.

When all errors are removed as below, click 🦃 or choose [Login] in Online menu to download the program to CPU.

メッセージ - 合計 0 エラー, 0 警告, 0 メッセージ				
Build - OII	<u>9</u> - (	0 警告 🚺 0 🤉	メッセージ 🗙	
説明		プロジェクト	オブジェクト	位置
Build started: Application: HX_CP1H16.Application				
typify code				
Compile complete 0 errors, 0 warnings				

If no application is in the CPU, this message appears. Click [Yes] to download.

HX-CODE	ESYS
?	アプリケーション 'Application' は、デバイス Device にありません。作成してダウンロード を続けますか?
	(はい) いいえ <u>D</u> etails

If unknown version of application is in the CPU, this message appears. Click [Yes] to download.



When logging in successfully, green circle icon is displayed at [Device]. If mounted I/O modules are matched with configured ones, green icon is displayed at each I/O module also.

hative

entai

jentativo

デバイス (D) 👻
B Dutitled 18
🖃 📀 🕤 Device [接続完了] (HX-CP1S08)
🖃 🗐 Plc Logic
🖃 🍈 Application [運転]
一 🎁 ライブラリ マネージャ
PLC_PRG (PRG)
🖃 🎆 Task Configuration
🖃 🎲 MainTask
PLC_PRG
🖃 🧐 Basic (Basic)
【 <空>(<空>)
and a state of a state

If any mounted I/O module is mismatched, red triangle icon is displayed at mismatched module as below.



entative

#### Online change (RUN 中変更)

オンライン変更は、ユーザプログラムを運転中(RUN中)に、運転中のままプログラムの変更を行うこ とが出来る機能です。オンライン変更は、変更したプログラム部分のHX-CPUへダウンロードを行います。

▲ 注 意
オンライン変更は、実行中のユーザプログラム変更と再起動を行います。対象のシステムによっては、 機器が誤動作し、人体に危険が及ぶ可能性があります。新しいユーザプログラムが対象のシステムで 正常に動作することを十分に検証してから行ってください。

#### Online change

To change your program in running CPU (online change), you have to logout at first. After program changing, choose [Login] again. You will have 3 options as below.

オン	ライン <mark>(0)</mark>	デバッグ D	ツール 🔟	ウィンドウ 🕐
СŞ	ログイン(	L)		Alt+F8
0ğ	ログアウト	( <u>O</u> )		Ctrl+F8
	ブートアブ	リケーションの名	E成 (C)	

Login with online change: Login with download: Login without any change:

オレレィ

Only incremental program is downloaded without CPU stop. Whole the program is downloaded. CPU is forced to stop. New program is not downloaded.

CODESY	′S 🔀
?	プログラムが前回のダウンロード時から変更されています。
	Options
	◎ オンライン変更してログイン
	◎ ダウンロードしてログイン
	◎ 変更せずにログイン
	Update bootproject
	<u>OK</u> キャンセル <u>D</u> etails

オンライン変更前に「クリーン」もしくは「全てをクリーン」を行った場合、新しいプログラムをダウンロ ードしないとログインが出来なくなり、オンライン変更が出来なくなりますのでご注意ください。

#### 注意

ポインタ変数は、前回実行された最終サイクルでの値を保持します。オンライン変更によりポインタ変数 が変更になる場合は、ポインタ変数は正しい値とならない可能性があるため、各サイクルで再度割り当てて ください。

#### Logout

アイコンをクリックまたは「オンライン」メニューの「ログアウト」を選択してください。
 ユーザプログラムの I/O 点数が約 30,000 点を超えるとログオフに時間がかかることがあります。30,000 点以上の I/O を使用する場合は POU を分け、モニタ不要な POU は閉じておくことで回避可能です。

## 2.10 Boot application

The basic overview of downloading is shown as below picture. Be noted that an application (compiled user program) is downloaded to volatile RAM memory of the CPU, which means the application is lost when power is removed. If your application needs to be saved in non-volatile FLASH memory, choose [Create boot application] in Online menu while Login. When CPU is power up in the next time, the application is copied from FLASH to RAM and executed automatically if RUN/STOP switch is in RUN position.



#### \*: Optional

Timing to download boot application can be configured in [Properties] of [Application] (Right click on "Application" of the project tree). The default setting is shown below.



entativ,

## 2.11 Source Download / Upload

Besides boot application, source file can be saved in the CPU module, which enables you to upload original program file from PLC even if you don't have it in your PC. Some extra files can be added to source file as below. Choose according to your necessity.

Compile options	Source Download		
<ul> <li>Compiler warnings</li> <li>Page Setup</li> <li>Security</li> <li>SFC</li> <li>Source Download</li> <li>Static Analysis Light</li> <li>Users and Groups</li> <li>Visualization</li> <li>Visualization Profile</li> </ul>	Destination device <pre> <pre> <pre> </pre> <pre> Content The project file itself is always part of t </pre> <pre> <pre> Use compact download Additional files </pre>  Timing </pre>  Timplicitly at program download and </pre>  Implicitly at creating bootproject </pre> Implicitly at creating bootproject, dc   Prompt at program download and o   Only on demand	Additional files          Download information files         Library profile         Referenced devices         Referenced libraries         Visualization Profile	
		OK Cancel	

#### **Download information files**

"Download information files" in [additional files setting] is not necessary normally, but it is needed if you want to login without CPU stop from the PC which does not have original program file shown below as case (b) and (c). (a) Online change from PC with source file to CPU without source file. → Login

(b) Online change from PC without source file to CPU with source file and DL info. → Source upload and Login (c) Online change from PC without source file to CPU with source file. → Source upload and Login, then program download is required because HX-CODESYS is not able to verify program identity. It is possible to login after



#### 2.12 Run / Stop / Reset / Initialize

#### Run/Stop

CPU can be started with HX-CODESYS or Run/Stop switch on the CPU module, but remote controlling with HX-CODESYS is not allowed when the Run/stop switch is in Stop position as shown below.

Switch position User operations	STOP	RUN
Stop with HX-CODESYS	Stop (no effect)	Stop
Run with HX-CODESYS	Stop (no effect)	Run
Reboot PLC (Cycle power)	Stop	Run *

\* CPU starts running independent from the last status before power failure.

HXM-013

HX-CPUは、運転開始時に基本/増設ベース上のI/Oモジュールに対しハードウェアリセットを行います。 このため、停止中に出力する設定/条件の場合でも運転停止→運転開始のタイミングで 1 タスク周期分、出 力が OFF します。

RUN 開始から初期値データを出力へ反映するまでの時間が長い

#### Reset

When CPU detects a serious error called "exception", such as watchdog error, program execution stops. If EHV-CODESYS is connected, "Exception" indication blinks until this status is cleared. This exception status is cleared only by "Reset" operation. HX-CODESYS has 2 different types of "Reset" operation: Reset warm and Reset cold. All of them can initialize exception status, but behaviours of CPU are different as shown below. Be noted that "Reset origin" initializes not only an exception but also your application and boot application in CPU module.

#### 初期化

例外状態の解除及び変数の初期化だけでなく不揮発性メモリの内容をリセットする場合は「初期化」操作 を行います。「初期化」には「リセット(PLC 初期化)」「デバイス [Device]をリセット(PLC 初期化)」の2 種類がありそれぞれ動作が異なります。初期化される内容は、下表を参照してください。

「リセット(PLC 初期化)」は、複数のプログラムが PLC 内に存在する場合は現在アクティブに設定され ているアプリケーションプログラムのみが消去されます。複数のプログラムすべて初期化する場合にはデバ イスツリーの[Device]の右クリックメニューの「デバイス [Device]をリセット (PLC 初期化)」を実行してく ださい。この際、Visu フォルダも同時に初期化されますのでご注意ください。

OperationVAR VAR NVAR RETAI NVAR PERSIST ENTApplicatio (in volatile memory)applicatio (in volatile (in volatile non-volatilefolder (nSTOPXXXXXXXReset warm-XXXXXXXXXXXReset coldXXXXXXXXXXDownloadXXXXXXXXXXOnline ChangeXXXXXXXXXXXReset originXXXXXXXXReset originXXXReset originXX						Boot	Boot	Visu
OperationVAR VARRETAI RETAI NPERSIST ENT(in volatile (in volatile memory)nnn <t< td=""><td></td><td></td><td>VAR</td><td>VAD</td><td>Application</td><td>applicatio</td><td>applicatio</td><td>folder</td></t<>			VAR	VAD	Application	applicatio	applicatio	folder
OperationVARREFARPENT(in volatile memory)(in volatile non-volatile non-volatile ))Online userSTOPXXXXXXXReset warm-XXXXXXReset coldXXXXXDownloadX(overwritten)X(modified)XOnline ChangeXXX-XXXReset originXX	Operation	VAR	RETAI	PERSIST	(in volatile	n	n	
NLATIncludy/ non-volatilenon-volatile non-volatileSTOPXXXXXReset warm-XXXXXReset coldXXXXDownloadX(overwritten)X(modified)XOnline ChangeXXXX-XXXReboot PLC-XXXXReset originX	operation	VIII	N	FNT	(III volatile	(in	(in	Online user
STOPXXXXXXXReset warm-XXXXXXReset coldXXXXXDownloadX(overwritten)X(modified)XOnline ChangeXXXXXXRebot PLC-XX-XXXReset originX				LITI	memory)	non-volatile	non-volatile	
STOPXXXXXXXReset warm-XXXXXXReset coldXXXXXDownloadX(overwritten)X(modified)XOnline ChangeXXX(modified)X(modified)XReboot PLC-XX-XXXReset originX						)	)	
Reset warm-XXXXXXReset coldXXXXXDownloadX(overwritten)X(modified)XOnline ChangeXXX(modified)X(modified)XReboot PLC-XX-XXXReset originX	STOP	Х	Х	Х	Х	Х	Х	Х
Reset coldXXXXXDownloadX(overwritten)X(modified)XOnline ChangeXXX(modified)X(modified)XReboot PLC-XX-XXXReset originX	Reset warm	-	Х	Х	Х	Х	Х	Х
Download-X(overwritten)X(modified)XOnline ChangeXXX(modified)X(modified)XReboot PLC-XX-XXXReset originX	Reset cold	-	-	Х	X	X	X	Х
Online ChangeXXX(modified)X(modified)XRebot PLC-XX-XXXReset originX	Download	-	-	Х	(overwritten)	X	(modified)	Х
Reboot PLC         -         X         X         -         X         X         X           Reset origin         -         -         -         -         -         X         X         X	Online Change	Х	Х	Х	(modified)	X	(modified)	X
Reset origin         -         -         -         -         X	Reboot PLC	-	Х	Х	-	Х	Х	Х
	Reset origin	-	-	-	-	-	-	X
0,00				-	·	•		
2 - 32				2 – 32				

jentativo

(Initialize PLC)			2				
Reset origin device [Device]	-	-		-	-	-	-

X = maintained, - = initialized

### Note

転送したプログラムを HX-CODESYS の[Device]-[ファイル]の操作で名称変更しプロジェクトファイルの アプリケーション名称と不一致にした状態では「リセット (PLC 初期化)」「デバイス [Device]をリセット (PLC 初期化)」共に動作しません。

#### Stop switch definition

entative

Definition of stop position of run/stop switch can be configured as "Stop" or "Reset warm" in CPU configuration. Default setting is "Reset warm" since it is almost same behaviour of original "Stop" for existing Hitachi PLC.

entative

entative

Parameter	Туре	Current Value	Prepared Value
🗄 - 📴 LAN			
🗄 🔤 NTP			
🗄 🛄 FTP			
Stop switch definition	Enumeration of BYTE	Reset warm	
Reset all outputs in STOP	Enumeration of BYTE	Yes	
Battery error detection	Enumeration of BYTE	Enable	
I/O config error detection	Enumeration of BYTE	Enable	
Program up/download by USB memory	Enumeration of BYTE	Disable	

#### 2.13 Global network variables

Any variables can be listed in global network variable list, which are sent to all other CPUs in the network with broadcast address of UDP/IP. Global net work variable function is available only in professional setting. Refer to section 3.2 Start up how to change the environment setting.

#### How to configure?

Procedure of configuration is shown below with a simple project: one CPU to send and the other CPU to receive. Right click on the project and choose "Add Device" to add the 2nd CPU.



### [ CPU "Send" ]

Right click on "Application" of send-CPU and choose "Network Variable List (Sender)".



### Network type: Choose "UDP". Settings : Set broadcast address

Task: Choose any one task. The variables are sent at the end of a task cycle.

Add Network Variable L	ist (Sender) iable list to send via a network pertiesto edit settings)	×			
<u>N</u> etwork typ <u>T</u> ask: MainTask List identifier: 1 ✓ <u>P</u> ack variables ☐ Transmit <u>c</u> hecksum ☐ <u>A</u> cknowledgement	Settings	Netwo Para Port Broad	ork settings for NVL meter Value 1202 Icast Adr. 192.168/2/255	Default value 1202 255.255.255	OK Cancel
<ul> <li>✓ C<sub>X</sub>clictransmission</li> <li>☐ Transmit on change</li> <li>☐ Transmit on event</li> </ul>	Inter <u>v</u> al: T#50ms Minimum ga <u>p</u> :T#20ms Variable:		ETH1 ETH2 ETH3	192.168.0.255           192.168.1.255           192.168.2.255	
40	Add Cancel			47	V

ITIVE

List identifier: If more than 2 global variable list is configured, set a number in ascending order.

Cyclic transmission: Since variables are sent every task cycle, set interval time as same or bigger than cycle time of configured task. If smaller time than task cycle is set, actual sending cycle is limited by task cycle.

Transmit on change: Variables are sent only if their values have changed; the Minimum gap can define a minimum time lapse between transfers.

Transmit on event: Variables are sent while specified variable is TRUE. Be noted that it is not edge detection but level detection.

Refer to online help of HX-CODESYS for further information.

In this sample, one global variable "test\_var" is defined and one-line program is written in POU as below.



送信側のパラメータの設定が完了したら、作成した変数リスト<NVL>を右クリックして「プロパティ」を 選択します。「Link To File」 タブにてエクスポートするファイルを作成します。ネットワーク変数として 255 バイト以上の STRING/WSTRING 型は使用できません。尚、「Network properties」タブにて、送信側のパラ メータを修正することが出来ます。

#### Note

プロパティはオンライン中でも設定を変更することが可能ですが、HX-CPUに設定がダウンロードされない ので、ログアウトした状態で設定を変更し、その後ログインしてダウンロードを行ってください。

Device (HX-CP 1H 16)		Properties - NVI [Device: PLC Logic: Application]	1
Ibirary Man         PLC_PRG (F         PLC         MainTa         PLC         PLC <th>Cut Copy Paste Delete Browse Refactoring Properties Add Object</th> <th>Common Link To File Access control Network variables Build )  Ellename: C Import before compile © Export before compile</th> <th>762</th>	Cut Copy Paste Delete Browse Refactoring Properties Add Object	Common Link To File Access control Network variables Build )  Ellename: C Import before compile © Export before compile	762
<pre></pre>	Add Folder Edit Object Edit Object With	<u>QK Cancel Apply</u>	iv.

#### [ CPU "Receive" ]

The next step is configuration for receiving CPU. Right click on "Application" of Receive-CPU and choose "Global Network Variable List..." Be sure to check if Sender is properly set as configured list above.



Add

Cancel

Configuration is completed for both send and receive-CPU.

### Note

- If any parameters of global variable list is changed, be sure to execute "Clean" or "Clean All" before login.
- If more than 2 global variable lists are configured, be sure to set another "List identifier" in ascending order.

Properties - NVL [Device:	PLC Logic: Application]	X
Common Link To File Acces	ss control Network variables Build	
Network type: UDP	Catti	
T I Maintain		iigs
Task: MainTas	sk	
List identifier: 1		
ivo		6
2 – 36		
2 00		
2 – 36		

70

# 2.14 Library

inve E

In order to read/write HX-CPU's specific information, following libraries are available. Add necessary CmpHIESLib by choosing "Add library" as shown below.

Devices 🗸 🗸 🛪	👔 Library Manager 🗙	
Program     Program     Device (HX-CP1H16)	🏦 Add library 🗙 🕻 elete library 🛛 Properties 🗃 Details 🛛 🐺 Placeholders 👘 Library repository	,
E BI PLC Logic	Name	Namespace
Application	🖳 🕬 3SLicense = 3SLicense, 3.5.8.0 (3S - Smart Software Solutions GmbH)	_3S_LICENSE
Library Manager	😟 🕬 BreakpointLogging = Breakpoint Logging Functions, 3.5.5.0 (3S - Smart Software Solutions GmbH)	BPLog
PLC_PRG (PRG)	🖳 🕬 CAA DTUtility = CAA DTUtil Extern, 3.5.5.0 (CAA Technical Workgroup)	DTU
= 🔣 Task Configuration	😟 👓 🕬 CAA File = CAA File, 3.5.7.0 (CAA Technical Workgroup)	FILE
🖹 😒 MainTask	🖼 👓 🚥 CAA Types = CAA Types Extern, 3.5.5.0 (CAA Technical Workgroup)	CAA
	CmpHIESErrors_HX = CmpHIESErrors_HX, 3.5.8.21 (HIES)	CmpHIESErrors_HX
Trace	• CmpHIESLib_HX = CmpHIESLib_HX, 3.5.8.21 (HIES)	CmpHIESLib_HX
Basic (Basic)	IoDrvEthernet = IoDrvEthernet, 3.5.8.20 (3S - Smart Software Solutions GmbH)	IoDrvEthernet

Libraries as shown below are loaded automatically when new project is opened.

Loaded libraries automatically					
Name of Library	Note				
IoStandard					
3SLincense					
Util					
CAA DTUtility					
CAA File					
SysCom					
CAA Types					
CmpHIESLib_HX	Note 1				
CmpHIESErrors_HX	Note 1				

Note 1: Use libraries that the end characters are "HX". The other libraries are for EHV+ series.

If these libraries are not found in the library list as above, install library by choosing [Tools]-[Install library...].

<u> </u>		
<u>W</u> indow <u>H</u> elp	Millibrary Repository	×
ackage Manager	Location: System	Edit Locations
brary Repository	(C:¥ProgramData¥CODESYS¥Managed Libraries)	
Device Repository	Installed libraries:	
√isualization Styles Repository	Company: (All companies)	Install
icense <u>R</u> epository	(Miscellaneous)	Uninstall
License Manager	Application	
Scripting	Bystem	
Customize	+ 0 Test Versions (not recommended)	
Options		
	Group by category	Details
	Library Profiles	Close
ative	2-37	?ti

# 2.15 Version

Firmware version (Target-Version) of your CPU is monitored in communication settings of Device as below.

Select Device		×
Select the network path to the controller:		
Gateway-1	Device Name:	Scan network
HX-CPU [0001.C001]	HX-CPU	Wink
	Device Address:	
	Target Version:	
	3.5.8.21	
	Target Vendor:	
	Hitachi Industrial Equipment Systems Co., Ltd	14 -
	Target ID:	
	1070 0009	
	Target Name:	
	HX-CP1H16	
	Target Type:	
	4096	
		OK Cancel
	10	
	2 - 38	

# Chapter 3 Communication function

3.1 EtherCAT master

#### 3.1.1 Configuration

Right click opens "Add Device…" on "Device". To click "EtherCAT Mater" on "Add Device" window and click "Add Device" button.

Project	<b>.</b>
Device (HX-CP1H16)	X Cut
	Сору
Library Manager	Paste
PLC_PRG (PRG)	× Delete
🖃 🔮 MainTask	Properties
Basic (Basic)	Add Object
<pre>K <empty> (<empty>)</empty></empty></pre>	Add Folder
<pre>Compty &gt; (<empty>)</empty></pre>	Add Device
<pre>K <empty> (<empty>)</empty></empty></pre>	Update Device
<pre><empty> (<empty>)</empty></empty></pre>	Edit Object

Miscellaneous Fieldbusses cav CANbus and EtherCAT	
Miscellaneous Fieldbusses can CANbus and EtherCAT	
reidousses can CANbus and EtherCAT	
Brott EtherCAT	
III purtir Master	
EtherCAT Master     3S - Smart Software Solutions (	
A Sthar OT Mantar Saft Matian an Count Cafe Strange	
puppy category	<u> </u>
play all versions (for experts only)	
play outdated versions Ethercat	
2 i i i i i i i i i i i i i i i i i i i	
ation: But Master	
Please select a device from the	
EtherCAT Maste	er
/ou can select another target node in the navigator while this window is	
You can select another target node in the navigator while this window is pen.)	
Add Device Close	
Add Device Close	

To configure Ethernet port, following window is opened by double clicking "EtherCAT Master (EtherCAT Master)". And select Ethernet port to be used for EtherCAT Master by clicking "Browse...".

EtherCAT_Master X			
Seneral	✓ AutoconfigMaster/Slaves	EtherCAT	_
ync Unit Assignment	EtherCAT NIC Setting		
therCAT I/O Mapping	Destination Address (MAC)	🗹 Broadcast 🛛 🗖 Enable Redundancy	(*) Enable Redundancy is not
atus	Source Address (MAC) 00-00-00-00-00	Browse	supported.
	Network Name		
formation	Select Network by MAC     Select Network by	by Name	
	▲ Distributed Clock		
	Cycle Time 4000 💌 µs		
	Sync Offset 20 %		
	Sync Window Monitoring		
	Sync Window		
lect Network Adapter			
ice nework Adapter			
MAC address Name	Description		
- 000102030412 eth3			
000102030413 eth1	Select Ethernet port to be used.		
1010101010000 (Johnson -			
		Ohaut	
		Abort	
	3-1		

Usable devices are shown on "Add Device" window by clicking "EtherCAT Master" of Device tree. Press "Add Device" button after selecting using slave device.

entative



If the slave is connected actually, it is possible to search the device during online after doing communication configuration according to the description Chapter 3.8. After right clicking "EtherCAT Master (EtherCAT Master)" and cliking "Search Device", the connected device can be found. The found device can be added by clicking "Copy to Project".



#### 3.1.2 Ethernet communication configuration

Select "Yes" at "Change IP information". After logging on, this configuration information is uploaded to CPU but it is required PLC power on again to valid this configuration.

Communication Settings	Parameter	Туре	Value
	📮 🚞 LAN		
Applications	😟 🕀 🚞 ETH1		
•••	🕸 📴 ETH2		
ackup and Restore	🗐 📴 ЕТНЗ		
	🖉 🖗 IP Address	STRING	'192.168.2.1
les	🖉 🖗 Subnet Mask	STRING	255.255.255.0
	Ethernet port Link speed / Duplex mode	Enumeration of BYTE	Auto Negotiation
	🖤 🖗 Default Gateway	STRING	'0.0.0.0
·9	🖤 🖗 Change IP information	Enumeration of BYTE	No
Ceattings	🛱 泣 NTP		
.c settings	🚽 🖗 NTP function	Enumeration of BYTE	Disable
Caball	🖤 🖗 Port number	Enumeration of BYTE	ETH
C shell	Logical port number	STRING	'123
	🖤 🖗 Specified by	Enumeration of BYTE	IP address
sers and Groups	IP address or Host name	STRING	'0.0.0.0
	🖉 🖗 Access cycle	WORD(11440)	60
C Parameters	💮 🖗 Timeout	BYTE(1255)	10
	TimeZone	Enumeration of BYTE	шт

#### Cycle of EtherCAT task 3.1.3

EtherCAT Master task is created automatically separate from MainTask by adding EtherCAT master on Device Tree. EtherCAT\_Master configuration window will open after select "Edit Object" by double clicking or right clicking on "EtherCAT\_Master" task.



"Cycle" should be 1ms or more due to HX-CPU execute all processing with single microprocessor. If this value is too small "25 error" (Microprocessor Overload) will be detected. This cycle value depends on user program size or number of I/O module, but it is required to define more than 1ms for this value even if small program size or less number of I/O modules.

Priority ( 0.,31 ):	0			
Type	▼ Interval (e.g. t#200ms): 4000			
			10	
		3 – 3		

#### 3.1.4 Programming

I/O address of slave device are shown on below "EtherCAT I/O mapping" tab. Programming can be done after setting some variable name at this variable field as same as other external I/O.

General	Channels						
	Variable	Mapping	Channel	Address	Туре	Unit	Description
Process Data	🕀 - <sup>K</sup> ø		Control	%QW0	UINT		Control
	😟 🏘		Status	%IW0	UINT		Status
Startup Parameters	😥 🏘		Module RES	%ID1	UDINT		Module RES
	😟 🍬		Module WDT	%ID2	UDINT		Module WDT
EthorCAT I/O Manaina	😥 🏘		Module FAIL	%ID3	UDINT		Module FAIL
therear to happing	٠٠٠ 🏎		Module IDER	%ID4	UDINT		Module IDER
tatua	😟 🍫		FPGA Version	%IW10	UINT		FPGA Version
latus	😟 🏘		CPU Version	%IW11	UINT		CPU Version
formation							
i o motion							

#### Caution

- If power PLC on keeping RUN/STOP switch position RUN, due to EtherCAT master executes configuration process for slave device, starting timing of I/O refresh of EtherCAT slave will be delayed approximately 1 second comparing other standard external I/O refresh timing. If this delay impact system operation and it is required to avoid this delay, dedicated bit of "Instance name.Finised of EtherCAT master" is recommended to use in program. This bit will turn true after completing configuration of TherCAT master. It is shown as sample program described by using ST language in below.
- EtherCAT slave refresh cycle will delay with task cycle time maxim comparing I/O refresh cycle on basic or expansion base unit, due to EtherCAT communication is executed asynchronous "EtherCAT\_Master" task.

#### Sample program

In case of Instance Name of EtherCAT master is "EtherCAT\_Master"

#### 

#### END IF;

Program described this after will not be executed if during bit of EtherCAT\_Master.xConfigFinished is FALSE (OFF).

#### 3.1.5 Wiring

#### (1) Cable

Category 5 and more STP (Twisted pair with shield) cable is recommended.

111

#### (2) Hub

Standard hub can't be used for EtherCAT network. EtherCAT dedicated hub is required to use if hub is needed. (Ex. Model CU1128 made by Beckhoff)

#### Caution

When EtherCAT master function is used, the EtherCAT port is not used for the other EtherCAT master function. If Gateway function (Connection HX-CODESYS or HMI), Modbus-TCP function, Global network variable function etc. are used together with EtherCAT master function, EtherCAT performance will be lower or stopped.

entative

VR

#### 3.2 Modbus-TCP / RTU

#### 3.2.1 Overview

Supported function code by HX series are shown in below.

			Modbus-TCP		Modbus-RTU	
Hexadecimal	Decimal	Function code	Master	Slave	Master	Slave
			(Client)	(Server)		
0x01	01	Read coil status	Х	Х	Х	NA
0x02	02	Read input relay	Х	Х	Х	NA
0x03	03	Read keep register	Х	Х	Х	Х
0x04	04	Read input register	Х	Х	Х	Х
0x05	05	Write single coil	Х	Х	Х	NA
0x06	06	Write single register	Х	Х	Х	Х
0x0F	15	Write multiple coils	X	Х	Х	NA
0x10	16	Write multiple register	X	Х	Х	Х
0x17	23	Read/Write multiple register	X	X	Х	Х

X: Supported, NA: Not supported

Modbus communication processing is executed at "Bus Cycle Task" specified PLC configuration tab of Device. Any task can be specified for "Bus Cycle Task". If <undefined> is selected as in below screen, most shortest cycle task is "Bus Cycle Task" automatically.

Device X				
Communication Settings	Application for I/O handling:	Application	•	
Applications	PLC settings			
Backup and Restore	Behaviour for outputs in Stop:	Keep current values		
Files	Always update variables:	Disabled (update only if used in a task)		
.og	Edit Licenses			
9 C settinos	Bus cycle options			
PLC settings	Bus cycle task:	<unspecified></unspecified>		
aution				
ing Broadcast Query of M	odbus-TCP master and/or Modbu	s-RTU master are not supported.		

#### Caution

entative

#### 3.2.2 Modbus-TCP Master (Client)

Right click opens "Add Device..." on "Device". To click "Ethernet" on "Add Device" window and click "Add Device" button.





Click "Ethernet" of Device tree by keeping "Add Device" window open, usable devices are shown on "Add Device" window. Select "Modbus TCP master" and press "Add Device" button.



Click "Modbus\_TCP\_Slave Device" by keeping "Add Device" window open, "Modbus\_TCP\_Slave Device" is shown on "Add Device" window and select this and press "Add Device" button. Add "Modbus TCP slave" according actual system. In case of three slave units are used, three "Modbus TCP slave" are shown under master.



Device (HX-CP1H16)	
PLC Logic	
😑 🙆 Application	
Library Manager	
PLC_PRG (PRG)	
POU (PRG)	
Task Configuration	
🗐 🌑 MainTask	
PLC_PRG	
🐮 🕤 Basic (Basic)	
😑 🚮 Ethernet (Ethernet)	
Modbus_TCP_Master (Modbus TCP Master)	
Modbus_TCP_Slave (Modbus TCP Slave)	
Modbus_TCP_Slave_1 (Modbus TCP Slave)	Configure these according to Control object
Modbus_TCP_Slave_2 (Modbus TCP Slave)	

Select Ethernet port to be used. After configuring communication, double clicking "Ethernet (Ethernet)" opens following window. Click "…" to select Ethernet port for Modbus-TCP usage.

Status     information     P address   Subnt mask   25	eneral	Interface:					
Address 122.108.0.1   Subnet mask 225.225.225.0   Default Gateway 0.0.0.0   Address   Norr Adapters   Address   102.108.0   Norr Adapters   Address   102.108.0   Address    Address    Address    Address    Address    Address    Address    Address    Address     Address     Address     Address     Address   Address	itatus	Use Operating Sys	tem Settings				
IP address 192.168.0   Subnet mask 255.255.255.0   Default Gateway 0.00.0   Recretation IP Address   Interfaces:   Nach 202108.0   192.108.0   192.108.0   192.108.0   192.108.1   Recretation IP Address   Interfaces:   Interfaces:   192.108.0   192.108.1   Recretation IP Address   Interfaces:   Interface:	nformation	Change Operating	System Settings				
Subnet mask       25: 25: 25: 0         Default Gateway       0         October       0         Subnet mask       0         Subnet mask       12:20.01         Hodress       12:20.01         Subnet mask       12:20.01         Subnet mask       0         Subnet mask       0         October       0         MAC-Address       0         MAC-Address       0         Ok       Concol		IP address	192 . 168 . 10 . 1				
Default Gateway     Default Gateway     Default Gateway     Packacper     Naco-Address:     A1372B006A170     Ot     Concording		Subnet mask	255 . 255 . 255 . 0				
twork Adapters         therfacion:         bit:       1921801         thi:       1921801         th:       1921801         th:       1921801         th:       1921801         th:       1921801         th:       1921801         t:       1921801         t: <td></td> <td>Default Gateway</td> <td>0.0.0.0</td> <td></td> <td></td> <td></td> <td></td>		Default Gateway	0.0.0.0				
Nume         Description         P Address           127.0.0.1         127.0.0.1           ethal         192.168.0.1           112         192.168.1.1           112         192.168.1.1           112         0         0           1265.2587.0         0           MAC-Address:         A437BB06A1:70			12.				
hteriaces: Name Decription P Address 192.168.1. P Address 192.168.1. Durinet marks 205.2256.206.0 MAC-Address: A497BB06A170 Ck Cancel	twork Adapters						
Name       Description       P Address         0       12700.1         eh1       192182.1         eh1       192183.13    P address          125.255.255.0       Decomposition         Defadit Gateway       0.0.0.0         MAC-Address:       A197BB06A170	nterfaces:						
∞     14.0001       eth     192.168.1       eth     192.168.1       IP address     192.168.0       10     0       0 <td>Name Description IP Address</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Name Description IP Address						
eth1 192.168.0.1   eth2 192.168.0.1   Select Ethernet port to be used.   IP address 192.62.05.00   Ck Cancel at Can	eth3 192.168.2.1				1		
eth2 192168.1.1  P address 192 168 0 1  Colorati Cathway 0 0 0 0 0  MAC-Address: A497BB08A1:70  Ok Cancel	eth1 192.168.0.1				Select Ethernet po	ort to be used.	
IP address 192 168 0 1 Subnet mask 255 .255 .0 Default Gateway 0 .0 .0 .0 MAC-Address: A497BB06A170 C/k Cancel	eth2 192.168.1.1						
IP address       192.168.0.1         Subnet mask       255.255.0         Default Gateway       0.0.0.0         MAC-Address:       A497.BB.05.A1.70         Ok       Cancel							
Subnet mask 255.255.0 Default Gateway 0.0.0.0 MAC-Address: A497BB06A1:70 Ok Cancel II		_					
Default Gateway 0.0.0.0 MAC-Address At 97:0BB:06:At 170 OK Cancel t	IP address 192 . 168 . 0 . 1						
MAC-Address: A197BB/06:A170	IP address         192 . 168 . 0 . 1           Subnet mask         255 . 255 . 255 . 0						
	IP address         192 . 168 . 0 . 1           Subnet mask         255 . 255 . 255 . 0           Default Gateway         0 . 0 . 0 . 0						
	IP address         192         168         0         1           Subnet mask         255         255         255         0           Default Gateway         0         0         0         0           MAC-Address:         A4:97:BB:06:A1:70         A4:97:BB:06:A1:70						
	IP address         192 . 168 . 0 . 1           Subnet mask         255 . 255 . 255 . 0           Default Gateway         0 . 0 . 0 . 0           MAC-Address:         A4.97:BB:06:A1:70		Oi	Cancel			
lati	IP address         192 . 168 . 0 . 1           Subnet mask         255 . 255 . 255 . 0           Default Gateway         0 . 0 . 0 . 0           MAC-Address:         A4:97:BB:06:A1:70		0	Cancel			
	IP address         192 . 168 . 0 . 1           Subnet mask         255 . 255 . 255 . 0           Default Gateway         0 . 0 . 0 . 0           MAC-Address:         A4:97:BB:06:A1:70		0	Cancel			
	IP address         192 . 168 . 0 . 1           Subnet mask         255 . 255 . 255 . 0           Default Gateway         0 . 0 . 0 . 0           MAC-Address:         A4.97:BB:06:A1:70			Cancel			
	IP address         192 . 168 . 0 . 1           Subnet mask         255 . 255 . 255 . 0           Default Gateway         0 . 0 . 0 . 0           MAC-Address:         A4:97:BB:06:A1:70			Cancel			
	IP address     192 . 168 . 0 . 1       Subnet mask     255 . 255 . 255 . 0       Default Gateway     0 . 0 . 0 . 0       MAC-Address:     A4:97:BE:06:A1:70			Cancel .d			
	IP address         192 . 168 . 0 . 1           Subnet mask         255 . 255 . 255 . 0           Default Gateway         0 . 0 . 0 . 0           MAC-Address:         A4:97:BB:06:A1:70			Cancel .d			
	IP address     192 . 168 . 0 . 1       Subnet mask     255 . 255 . 255 . 0       Default Gateway     0 . 0 . 0 . 0       MAC-Address:     A4:97:BB:06:A1:70			Cancel			
	IP address     192 . 168 . 0 . 1       Subnet mask     255 . 255 . 255 . 0       Default Gateway     0 . 0 . 0 . 0       MAC-Address:     A4:97:BB:06:A1:70			Cancel			
	IP address     192 . 168 . 0 . 1       Subnet mask     255 . 255 . 255 . 0       Default Gateway     0 . 0 . 0 . 0       MAC-Address:     A4:97:BB:06:A1:70			Cancel			
	IP address       192 . 168 . 0 . 1         Subnet mask       255 . 255 . 255 . 0         Default Gateway       0 . 0 . 0 . 0         MAC-Address:       A4.97:BB:06:A1:70			c Cancel .d			
	IP address       192       168       0       1         Subnet mask       255       255       255       0         Default Gateway       0       0       0       0       0         MAC-Address:       A4:97:BB:06:A1:70			Cancel .:	96.		
	IP address         192         168         0         1           Subnet mask         255         255         255         0           Default Gateway         0         0         0         0         0           MAC-Address:         A4:97:BB:06:A1:70         A4:97:BB:06:A1:70         A4:97:BB:06:A1:70			Cancel	9,		
	IP address       192       168       0       1         Subnet mask       255       255       255       0         Default Gateway       0       0       0       0       0         MAC-Address:       A4:97:BB:06:A1:70			Cancel	9/7/		
	IP address         192         168         0         1           Subnet mask         255         255         255         0           Default Gateway         0         0         0         0         0           MAC-Address:         A4:97:BB:06:A1:70         A4:97:BB:06:A1:70         A4:97:BB:06:A1:70			Cancel	977		

Issueing Function Code configuration are done by each slave. Following configuration windows are opened by doubleclicking for target slave. Configuration of IP address, response timeout and port number are done at this window.Unit-ID is only required to configure when Modbus gateway (Converter of Ethernet/Serial) is used.

al	Modbus-TCP		MODDUC
us Slave Channel	Slave IP Address:	<b>192</b> . 168 . 0 . 1	WUDBO2
s Slave Init	Unit-ID [1.,247]		
usTCPSlave Parameters	Response Timeout (ms) Port	502	
PSlave I/O Mapping	-		

Sending Function Code are configured by "Add Chanel" button of "Modbus slave channel".



Configure each Function Code according to following procedure. When "Trigger" configuration is selected as "Rising edge (Rising Edge)", Trigger variable (BOOL) is assigned as %QX address automatically.

Name	Channel 0		
Access Type	Read Holding Registers (Fund	tion Code 3)	•
Frigger	Cydic	Cycle Time (ms)	100
Comment			
READ Register			
Offset	0x0000		•
.ength	1		
Error Handling	Keep last Value	[	
WRITE Register			
Offset	0x0000		<b>*</b>
.enath	1		

entativ,

Jentativo

Seneral	Name	Access Type	Trigger	READ Offset	Length	Error Handling	W
	Channel 0	Read Holding Registers (Function Code 03)	Cyclic, t#100ms	16#0000	1	Keep last Value	
lodbus Slave Channel	Channel 1	Write Single Register (Function Code 06)	Cyclic, t#100ms				16
	Channel 2	Write Single Coil (Function Code 05)	Cyclic, t#100ms				16
dbus Slave Init							
dbusTCPSlave Parameters							
dbusTCPSlave I/O Mapping							
atus							
rmation							
formation							
formation							
formation					1		Þ

Reading/writing data are assigned %IW or %IQ address shown in "ModbusTCPSlave I/O Mapping" tab. The data read from slave is Input area (%IW) and the data wrote into salve is Output area (%QW).

General	Channels						
	Variable	Mapping	Channel	Address	Туре	Unit	Description
Modbus Slave Channel	🕀 - 🍬		Channel 0	%IW0	ARRAY [00] OF WORD		Read Holding Registers
no do do brar e entimen	±		Channel 1	%QW0	ARRAY [00] OF WORD		Write Single Register
Modbus Slave Init	±*.		Channel 2	%QB2	ARRAY [00] OF BYTE		Write Single Coil
Status							
Information							

#### Caution

entative

- Modbus Master sends is 1 channel Request dada every 1 cycle. Therefore in case of trigger set is "Rising edge (rising edge)" and if trigger variable changed so high-frequency, previous request data is not completed to send and it will be the timing for the next trigger and sometimes trigger may not be recognized correctly. In case of the time from the start of request data to the end of response data is T1, the rough calculation of inhibited time not to change trigger bit is described T1+T2+...+Tn.

#### 3.2.3 Modbus-TCP Slave (Server)

Add "Ethernet" same as Modbus-TCP master, add "Modbus TCP Slave Device" at "Add Device".



Select Ethernet to be used. After communication setting, following window appears by double clicking "Ethernet (Ethernet)". Select Ethernet port for Modbus-TCP by clicking "…".

Ethernet X					
General	Interface:				
Status	Operating	System Settings			
Information	Change Operat	ing System Settings			
	IP address	192 . 168 . 10 . 1			
	Subnet mask	255 . 255 . 255 . 0			
	Default Gateway	0.0.0.0			
	1				
Network Adapters			<b>—</b> ——		
Interfaces:					
Name Description IP Address					
lo 127.0.0.1			b		
eth3 192.168.2.1					
eth 1 192.168.0.1			S S	elect Ethernet port to be used.	
192.100.1.1					
	1				
IP address 192.108.0.1	]				
Subnet mask 255.255.255.0					
Default Gateway 0 . 0 . 0 . 0	<u>]</u>				
MAC-Address: A4:97:BB:06:A1:70					
		Ok	Cancel		

#### Caution

- Even it is possible to send response from other port (for example, in case of registering eth1, it means eth2 or eth3) registered as Modbus-TCP slave, it is recommended to execute communication by the port registered as Modus-TCP slave.

- Even it is possible to register eth1 – eth3 for Modbus-TCP slave, mapping table are not independent from others and are shared with others. Therefore, it is recommended to use Modbus-TCP slave with one port. Duplicated Modbus-TCP slave is detected as error, if several ports are used as Modbus-TCP slave.

- It will take approximately 1 minute to establish connection again, if warm reset is executed during establishing connection with Modbus-TCP master.

Open configuration window by double clicking "Modbus TCP Slave Device" and set needed parameters. However, do not change from 502 for slave port due to it is fixed.

Mapping table is created "ModbusTCP Slave Device I//O Mapping" tab according to configured size for Holding Registers (%IW) and Input Registers (%QW).

ModbusTCP Slave Devic	e V						
Thomaster_slave_bevic	Configured Parame	ters					
General	TimeOut:	2000	(ms)				
Modbus TCP Slave Device I/O Mapping	Slave Port:	502					
Information	Linit ID:	502					
	Holding Registers (	%1W): 10	=				
	Input Registers (%)	QW): 10					
	Data Model						
	Start Addresses:						
	Coils:	0	÷				
	Discrete Inputs:	0	÷				
	Holding Register:	0	-				
	Input Register:	o	-				
	🗖 Holding- and In	put-Register Data A	Areas overlay				
ModbusTCP_Slave_Device	×						
General	Channels						
Modbus TCP Slave Device I/O	Variable Map	ping Channel	Address	Туре	Default Value	Unit	Description
Mapping	- <b>1</b> 9 -	Inputs Inputs[0]	%IW0 %IW0	ARRAY [01] OF WORD WORD			Modbus Holding Registers
Information	<u> </u>	Inputs[1]	%IW1	WORD			Modbus Input Peoisters
		Outputs Outputs[0]	%QW0	WORD			Modbus Input Registers
	<b></b>	Outputs[1]	%QW1	WORD			
ach registers mentioned	l in below are phy	sically same	memory	area.			
- Input register (WOR	D) and Input relay	(BOOL)					
- Keep register (WOR	) and Coil (BOOL	.)					
	,	/					
ıt Register	ut Relay		]	Input Relay			
Ad	dress15 (0x000F)		-	Address0 (0x0000	))	Inp	ut Relay
		_				Ad	dress16 (0x0010)
Address 15/14	13 12 11 10	9 8	76	5 4 3 2	$1 \setminus 0$	/	
0000		ТŤТ				/	
0001							
0002							
p register Co	il			Coil			
Ad	dress15 (0x000F)		-	Address0 (0x0000	))	Coi	
		_				Ad	dress16 (0x0010)
Address 15/14	13 12 11 10	98	76	5 4 3 2	$1 \setminus 0$	/	
0000							
0001	v						
0002							

#### 3.2.4 Modbus-RTU Master

Select "Add Device" by right clicking "Device". Select "Modbus COM" of "Add Device" window and press "Add Device" button.



Keep "Add Device" window not to close, usable devices are shown in "Add Device" window by clicking "Modbus\_COM" of Device Tree. Select "Modbus Master, COM Port" and press "Add Device" button.



Keep "Add Device" window open and "Modbus Slave, COM Port" is shown by clicking "Modbus\_Mater\_COM\_Port", press "Add Device" button. Add "Modbus Slave, COM Port" according to actual system requirement. In case of three slave units are used, three "Modbus Slave, COM port" are under master.



#### Caution

It is required correct response for the response from Modbus-RTU salve unit. If illegal response is received, there is an illegal operation risk.

Configure port. Following window appears by double clicking "Modbus\_COM (Modbus COM)". Configure port according to slave to be used. Configure "1" for "COM Port" at HX-CPU side.

General	Serial Port Configuratio	n		
Status	COM Port	1		
	Baud Rate	9600	•	
nformation	Parity	EVEN	•	
	Data Bits	8		
	Stop Bits	1		

Configure Bus Cycle Task. Task configured here, configure priority "Less than equale 4" at this configuration. In caseofconfiguration more than 5, there is an illegal operation risk.

General	IEC Objects			
	Variable	Mapping	Туре	
1odbusGenericSerialMaster I/O 1apping	Modbus_Master_COM	. **	IoDrvModbusComPort	
itatus				
information				Y
	Configure priorit	y "Less tł	nan	
	equal 4" at this	specifyin	g task.	
	🍫 = Create new variable	~ 🎓 = M	ap to existing variable	
	Bus Cycle Options			
	Bus Cycle Task Use pare	nt bus cycle s	etting	
		3 – 1	3	

Conguration of issueing function code are done by each slave. Following configuration window appears by double clicking target slave. Configure slave adress and response timeout. Response timeout can be configured independently for each slaves and in case of both side configuration slave and master, cofigured value of slave is valid. In case of deleting default value of Slave response timeout, it is only the case to apply value of reponse timeout of master side.

Modbus_Slave_COM_Port	×		
General	Modbus-RTU/ASCII	BODDUS	
Modbus Slave Channel	Slave Address [1247]	MUDBUS	
Modbus Slave Init	Response Timeout [ms] 1000		
ModbusGenericSerialSlaveI/0 Mapping			

Configure function code sent by "Add Channel..." of "Modbus Slave Channel" tab.

General	Name	Access Type	Trigger	READ Offset	Length	Error Handling	WRITE Offset	Length	Comment
Iodbus Slave Channel									
odbus Slave Init									
lodbusGenericSerialSlave I/O lapping									
tatus									
formation									
	J						5 1 Sec.	. 1	1020

Configure following procedure for each function code. In case of selection of "Rising edge (rising edge)" for "trigger" setting, trigger variable (BOOL) is assigned %QX address automatically.

odbusChannel				×									
-Channel		-											
Name Channel 0													
Access Type Read Hold	ng Registers (Fund	tion Code 3)	•										
Trigger Cyclic	-	Cycle Time (ms)	100										
Comment													
READ Register													
Offset 0x0000			•										
Length 1													
Error Handling Keep last V	alue 💌	]											
WRITE Register			*										
Officiat 0x0000			(1873)										
Offset 0x0000													
Offset 0x0000 Length 1													
Offset 0x0000 Length 1			1										
Offset 0x0000		<u>o</u> ĸ	<u>C</u> ancel										
Offset 0x0000 Length 1		<u>Ö</u> K	<u>C</u> ancel										
Offset 0x0000 Length 1 Modbus_Slave_COM_Port	< Name	QK Access Type	<u>Cancel</u>	Trigger	RFAD Offset	Length	From Handling	WRITE Offset	length	Commer	<u>•</u>		
Offset 0x0000 Length 1 Modbus_Slave_COM_Port General	Name Channel 0	QK Access Type Read Holding Registers ()	<u>Cancel</u>	Trigger Cyclic, t#100ms	READ Offset 16#0000	Length 1	Error Handling Keep last Value	WRITE Offset	Length	Commer	•		
Offset 0x0000 Length 1 Modbus_Slave_COM_Port General Modbus Slave Channel	Name     Charnel 0     Charnel 1     Charnel 1	QK Access Type Read Holding Registers (I) Write Single Col (Functio Write Single Col (Functio	Function Code 03) nn Code 05)	Trigger Cyclic, t#100ms Cyclic, t#100ms Cyclic, t#100ms	READ Offset 16#0000	Length 1	Error Handling Keep last Value	WRITE Offset 16#0000 16#0000	Length 1	Commer	-		
Offset 0x0000 Length 1 Modbus_Slave_COM_Port General Modbus Slave Channel Modbus Slave Init	Name     Channel 0     Channel 1     Channel 2	QK Access Type Read Holding Registers () Write Single Col (Functio Write Single Col (Functio	Cancel	Trigger Cyclc, t#100ms Cyclc, t#100ms Cyclc, t#100ms	READ Offset 16#0000	Length	Error Handling Keep last Value	WRITE Offset 16#0000 16#0000	Length 1 1	Commer	•		
Offset 0x0000 Length 1 Modbus_Slave_COM_Port General Modbus Slave Channel Modbus Slave Init Modbus Slave Init Modbus Slave Init	Charnel 0 Charnel 0 Charnel 1 Charnel 2	QK Access Type Read holding Registers () Write Single Col (Functio Write Single Col (Functio	Function Code 03) in Code 05)	Trigger Cyclc, t#100ms Cyclc, t#100ms	READ Offset 16#0000	Length 1	Error Handling Keep last Value	WRITE Offset 16#0000 16#0000	Length 1 1	Commer	-		
Offset 0x0000 Length 1 Modbus_Slave_COM_Port Seneral Modbus Slave Init Modbus Slave Init Modbus Slave Init Status	<	QK Access Type Read Holding Registers () Write Single Coll (Functio Write Single Coll (Functio	Cancel	Trigger Cyclc, t#100ms Cyclc, t#100ms	READ Offset 16#0000	Length 1	Error Handling Keep last Value	WRITE Offset 16≠0000 16≠0000	Length 1 1	Commer	-		
Offset 0x0000 Length 1 Modbus_Slave_COM_Port General Modbus_Slave Init Modbus_Slave	K Charnel 0 Charnel 1 Charnel 2	QK Access Type Read Holding Registers () Write Single Coll (Functio Write Single Coll (Functio	Cancel	Triceer Cyclc, t#100ms Cyclc, t#100ms	READ Offset 16#0000	Length 1	Error Handling Keep last Value	WRITE Offset 16#0000 16#0000	Length 1 1	Commer	-		
Offset 0x0000 Length 1 Modbus_Slave_COM_Port General Modbus Slave Init Modbus Slave Init	K Name Channel 0 Channel 1 Channel 2	QK Access Type Read Holding Registers () Write Single Coll (Functio Write Single Coll (Functio	Cancel	Trigeer Cyclic, t#100ms Cyclic, t#100ms	READ Offset 16#0000	Length 1	Error Handling Keep last Value	WRITE Offset 16≠0000 16≠0000	Length 1 1	Commer	-		
Offset 0x0000 Length 1 Modbus_Slave_COM_Port General Modbus Slave Init Modbus Slave Init	Name     Channel 0     Channel 1     Channel 2	QK Access Type Read Holding Registers () Write Single Coll (Functio Write Single Coll (Functio	Cancel	Trigeer Cyclic, t#100ms Cyclic, t#100ms	READ Offset 16∉0000	Length 1	Error Handling Keep last Value	WRITE Offset 16#0000 16#0000	Length i i	Commer			
Offset 0x0000 Length 1 Modbus_Slave_COM_Port General Modbus Slave Init Modbus Slave Init	Name     Channel 0     Channel 1     Channel 2	QK Access Type Read Holding Registers () Write Single Coll (Functio Write Single Coll (Functio	Cancel	Trigeer Cyclic, t#100ms Cyclic, t#100ms	READ Offset 16∉0000	Length 1	Error Handling Keep last Value	WRITE Offset 16#0000 16#0000	Length 1 1	Commer			
Offset 0x0000 Length 1 Modbus_Slave_COM_Port General Modbus Slave Init Modbus Slave	Name Channel 0 Channel 1 Channel 2	QK Access Type Read Holding Registers (i Write Single Coll (Functio Write Single Coll (Functio	Cancel	Trigger Cyclc, t#100ms Cyclc, t#100ms	READ Offset 16∉0000	Length 1	Error Handling Keep last Value	WRITE Offset 16#0000 16#0000	Length 1 1	Commer			

entai

entativo

Read/Write data are assigned address of %IW or %QW shown on "ModbusGenericSerialSlaveI/OMapping" tab. Read data from slave is Input area (%IW) and Write data for slave is Output area (%QW). Value of "Default Value" is output value when the status change RUN  $\rightarrow$  STOP.

General	Channels	Channels								
	Variable	Mapping	Channel	Address	Туре	Unit	Description			
1odbus Slave Channel	🕀 - 🏘		Channel 0	%IW0	ARRAY [00] OF WORD		Read Holding Registers			
	<b>□</b> - <b>*</b>		Channel 1	%QB0	ARRAY [00] OF BYTE		Write Single Coil			
Modbus Slave Init	😟 - Ko		Channel 1[0]	%QB0	BYTE		Write Single Coil			
	🚊 🍢		Channel 2	%QB1	ARRAY [00] OF BYTE		Write Single Coil			
1odbusGenericSerialSlaveI/O	😟 - <sup>K</sup> ø		Channel 2[0]	%QB1	BYTE		Write Single Coil			
Information										

#### Caution

Modbus Master sends is 1 channel Request dada every 1 cycle. Therefore in case of trigger set is "Rising edge (rising edge)" and if trigger variable changed so high-frequency, previous request data is not completed to send and it will be the timing for the next trigger and sometimes trigger may not be recognized correctly. In case of the time from the start of request data to the end of response data is T1, the rough calculation of inhibited time not to change trigger bit is described T1+T2+...+Tn.

Shidik

Shiative

entative

#### 3.2.5 Modbus-RTU Slave

Add "Modbus COM" same as Modbus-TCP master, add "Modbus Serial Device" at "Add Device".

Devices 🚽 🗸	
Project  Project  Project  Project  Povice (HX-CP1H16)  PLC Logic  POU (PRG)  POU (PRG) POU (PRG)  POU (PRG)  POU (PRG)	Name Fieldbusses Modbus Serial Device Modbus Serial Device Modbus Serial Master Modbus Master, COM Port
Modbus_COM (Modbus COM)	

Configure port. Following window appears by double clicking "Modbus\_COM (Modbus COM)". Configure port according to using master. Configure "1" for "COM Port" at HX-CPU side.

eneral	Serial Port Configurat	tion
atus	COM Port	1 *
	Baud Rate	9600
nformation	Parity	EVEN
	Data Bits	8
	Stop Bits	1

Open configuration window by double clicking "Modbus TCP Slave Device" and configure needed parameters. Mapping table is created in "Modbus Serial Slave Device I/O Mapping" tab according to the configured size on Holding Registers (%IW) and Input Registers (%QW).

8 8		<del>-</del>	
Modbus_Serial_Device 🗙			
General	Unit ID:	1	
Modbus Serial Device I/O Mapping	Time Out:	2000	

3712

Holding Registers (%IW): 10

Input Registers (%QW): 10

Modbus Serial Device ¥

Information

General	Channels									
	Variable	Mapping	Channel	Address	Туре	Default Value	Unit	Description		
Modbus Serial Device I/O Mapping			Inputs	%IW0	ARRAY [09] OF WORD			Modbus Holding Registers		
Information	🖮 🍫		Inputs[0]	%IW0	WORD					
				%IW1	WORD					
	ii ¥≱		Inputs[2]	%IW2	WORD					
	🗎 🍫		Inputs[3]	%IW3	WORD					
	🗎 🖶 🧤		Inputs[4]	%IW4	WORD					
	🗎 🍫		Inputs[5]	%IW5	WORD					
	۰. ۲		Inputs[6]	%IW6	WORD					
	🗎 🍫		Inputs[7]	%IW7	WORD					
	ii		Inputs[8]	%IW8	WORD					
	🛓 🗄 🍫		Inputs[9]	%IW9	WORD					
	i		Outputs	%QW0	ARRAY [09] OF WORD			Modbus Input Registers		

\*

#### Caution

It is reqired Master query to follow Reguration of Modbus specification data format. In case of non-supported function code, out of range of address, data, data value etc, HX-CPU may not response correctly.

'a

l'atil
VG

## 3.3 CPU Link

#### 3.3.1 Overview

CPU Link System is Network System exchanging data via loop type connection among CPU Link Modules. Each CPU accesses shared memory called Link Area via CPU Link Module. Link Area is defined as Global Variable List (GVL) at each CPU side, %M address is used for accessing Link Area data. %M address is commonly used address among all CPUs.

GVL is added by right clicking "Application" shown in below.



#### 3.3.2 Configuration Link parameter

Open "EH-LNK parameter" display by double clicking EH-LNK on tree and configure "Offset address of writing area (Writing area %MW offset address)" and "Size of writing area (Size of writing area)".

H-LNK I/O Mapping	Parameter	Туре	Current Value	Prepared Value	Value	Default Value	Unit	Description
	🖉 🌵 LINK area %MW-address	WORD	0		0	0		LINK memory can be accessed by %M variables begi.
itus	<ul> <li>Ø Offset address of writing area</li> </ul>	WORD(01023)	0		0	0		Set the offset address of writing area [0-1023](a)
ormation	Size of writing area	WORD(01024)	0		0	0		Set the size of writing area [0-1024]. Max.=1024-(a)

#### Caution

Value of configuration range are shown in below. HX-CODESYS may not detect error even if configured value are beyond following range.

• Offset address of writing area :  $0 \sim 1023$ 

 $: 0 \sim 1024$ 

Size of writhing area

entative

(However, maximum is subtract "Offset address of writing area" value from 1024)

entativ,

lative

Power

Supply

entative

C | D | L | D | D | L

U 16 N 16 16 N

κ

1

2 3

0

κ

4

#### Configuration example

This example shows three CPUs. Each CPU has each writing area and not be duplicated. Certain writing area of CPU is reading area for the other CPUs.



In case of CPU Link module number is one, Link area address is %MW0 - %MW1023. If several number of CPU Link modules are used in below figure, Link area address are shown in below table. This is defined by number of CPU Link modules not by mounted slot number of CPU Link modules.

	LINK-1	LINK-2	LINK-3	LINK-4	LINK-5	LINK-6	LINK-7	LINK-8
From	%MW0	%MW1024	%MW2048	%MW3072	%MW4096	%MW5120	%MW6144	%MW7168
То	%MW1023	%MW2047	%MW3071	%MW4095	%MW5119	%MW6143	%MW7167	%MW8191

•	LINK-T:	$\%$ IVIV $0$ $\sim$ $\%$ IVIV $1023$
٠	1 INK-2.	%MW1024~%MW204

entai

entative

Phia

entative.

#### 3.3.3 Declaration of Link Variable

If new variable is started to use during programming, "Automatic Declaration" dialog appears. In case of Link variable, configure %MW address at address field as "VAR\_GLOBAL" in scope field. This is assigned GVL automatically by pressing OK button.

	<u>N</u> ame:	Type:
VAR_GLOBAL	wtest_link0	WORD >
<u>O</u> bject:	Initialization:	Address:
GVL [Application]	•	%MW0
RETAIN PERSISTENT		OK Cancel
🧉 GYL		

Global variable declared here is used in POU. In the above case, it is "GVL.wTest\_link0".

It is also possible to use BOOL Type or BYTE Type %M address.



#### Caution

Take care for "Word Swap" of DWORD Type data when make communication with EHV+ series via CPU Link module.

EHV+ : %MD0 = 16#1234 5678 → HX : %MD0 = 16# 5678 1234 entative

	IEC address		Hitachi CPU	Link address	
bit	byte	word	bit	word	
%MX0.0	%MB0	%MW0	L0000	WL000	
%MX0.1			L0001		
%MX0.2			L0002		
%MX0.3			L0003		
%MX0.4			L0004		
%MX0.5			L0005		
%MX0.6			L0006		
%MX0.7			L0007		
%MX1.0	%MB1		L0008		
%MX1.1			L0009		
%MX1.2			L000A		
%MX1.3			L000B		
%MX1.4			L000C		
%MX1.5			L000D		
%MX1.6			L000E		
%MX1.7			L000F		
%MX2.0 to 2.7	%MB2	0/ <b>M</b> W1	L0010 to 001E	WI 001	
%MX3.0 to 3.7	%MB3	% IVI W 1	L0010 to 001F	WL001	
%MX4.0 to 4.7	%MB4	04 MW2	L 0020 to 002E	WI 002	
%MX5.0 to 5.7	%MB5	% IVI W 2	L0020 to 002F	WL002	
%MX6.0 to 6.7	%MB6	0/ MW2	L 0020 to 002E	WI 002	
%MX7.0 to 7.7	%MB7	%IVI W 5	L0050 to 005F	W L003	
			•••	•••	
%MX2044.0 to 2044.7	%MB2044	% MW1022	I 3FE0 to 3FEE	WI 3FF	
%MX2045.0 to 2045.7	%MB2045	701VI VV 1022		WLJTE	
%MX2046.0 to 2046.7	%MB2045	% MW1023	L 3EE0 to 3EEE	WI 3EE	
%MX2047.0 to 2047.7	%MB2047	701VI VV 1023		W LJFF	

IEC address is decimal number shown in below, however Hitachi CPU Link address is hexadecimal number.

#### Caution

entative

In case of no usage of CPU Link module, %M address can be used as general internal register.

l'ative

antai

Shiai

ntative

# 3.4 FL-net interface

#### 3.4.1 Overview

FL-net is open FA network supporting Data sharing among CPUs of multi vendors based on Ethernet. Cyclic data sharing executed by each CPU using virtual shared memory called common memory.



Common memory 1 and Common memory 2 are available for cyclic data and HX-CPU uses %M address same as CPU Link for this common memory.

Common memory 1 uses same address range with other CPU Link module.

LINK No.	LINK-1	LINK-2	LINK-3	LINK-4	LINK-5	LINK-6	LINK-7	LINK-8
Start of common1	%MW0	%MW1024	%MW2048	%MW3072	%MW4096	%MW5120	%MW6144	%MW7168
End of common1	%MW511	%MW1535	%MW2559	%MW3583	%MW4607	%MW5631	%MW6655	%MW7679
Un-used range	%MW512- %MW1023	%MW1536- %MW2047	%MW2560 %MW3071	%MW3584 %MW4095	%MW4608 %MW5119	%MW5632 %MW6143	%MW6656 %MW7167	%MW7680 %MW8191

Usable range at each LINK No. is 512 words from the top due to maximum size for common memory 1 is 512 words. When FL-net is used, it is not possible to use address of non-used range in above.

Common memory 2 uses %M address assigned for FL-net usage.

FL No.	FL-1	FL-2
Start of common2	%MW8192	%MW16384
End of common2	%MW16383	%MW24575

Maximum size of common memory2 is 8192 words.



Common1: %MW1024 - %MW1535 Common2: %MW8192 - %MW16383

- Common1: %MW3072 - %MW3583 Common2: %MW16384 - %MW24575

### 3.4.2 FL-net parameter configuration

Configure each parameter after opening "EH-FLN parameters" display by double clicking EH-FLN2\_3 on tree.

LN Parameters	Parameter	Туре	Value	Default Value	Unit	Desc
EH-FLN I/O Mapping	IP Address	STRING	'192.168.250.1'	'192.168.250.1'		IP Ad
	CmnMem-1 %MW address	WORD	0	0		Starti
IS	<ul> <li>CmnMem-1 writing area address (offset)</li> </ul>	WORD(0511)	0	0		Starti
	CmnMem-1 writing area size	WORD(0512)	0	0		Size o
mation	CmnMem-2 %MW address	WORD	0	0		Starti
	<ul> <li>Ø CmnMem-2 address (offset)</li> </ul>	WORD(08191)	0	0		Starti
	CmnMem-2 size	WORD(08192)	8192	8192		Size o
	<ul> <li>CmnMem-2 writing area address (offset)</li> </ul>	WORD(08191)	0	0		Starti
	CmnMem-2 writing area size	WORD(08192)	0	0		Size o
	🖤 < Token watchdog time	BYTE(1255)	50	50	ms	Token
	Allowable min. frame interval time	BYTE(050)	0	0	100us	Allowa
	Type and vendor name	Enumeration of BYTE	EH-FLN3/HITACHI-IES	EH-FLN3/HITACHI-IES		Type
	🖤 🚸 Node name	STRING	'Node 1'	'Node 1'		Node
	<ul> <li>Ø Clear data in STOP (CmnMem-1)</li> </ul>	Enumeration of BYTE	No	No		Clear
	Clear data in STOP (CmnMem-2)	Enumeration of BYTE	No	No		Clear

No.	Name	Explanation	Default
1	IP address	Set IP address of EH-FLN2/3	192.168.250.1
2	CmnMem-1 %MW address	Display starting address at On-line.	0
3	CmnMem-1 writing area address	Configure starting address (offset) of sending area of	0
	(offset)	own node at common memory1.	
4	CmnMem-1 writing area size	Configure size of sending area of own node by word	0
		unit at common memory1.	
5	CmnMem-2 %MW address	Display starting address at On-line.	0
6	CmnMem-2 address (offset)	Configure starting address (offset) of data transfer	0
		between CPU module and EH-FLN2/3 at common	
		memory2.	
7	CmnMem-2 size	Configure size of data transfer between CPU module	0
		and EH-FLN2/3 by word unit. Configure added value	
		of own node sending size and other node sending size.	
8	CmnMem-2 writing area address	Configure starting address (offset) of sending area of	0
	(offset)	own node by word unit at commonmemory2.	
9	CmnMem-2 writing area size	Configure size of sending area of own node by word	0
		unit at common memory2.	
10	Token watchdog time	Configure monitoring time between token receiving at	50
		own node and token passing for next node.	
11	Allowable min. frame interval time	Time between token receiving at own node and some	0
		sending frame from own node.	
12	Type and vendor name	Select vendor name and model name.	EH-FLN3/
		There is no difference among these.	HITACHIIES
13	Node Name	Configure some name with byte character or number	Node1
		within 10 characters.	
14	Clear data in STOP (CmnMem-1)	Configure clear sending area of common memoryl or	No
		not when CPU module stops.	Ŋ
15	Clear data in STOP (CmnMem-2)	Configure clear sending area of common memory2 or	No
		not when CPU module stops.	
	6	3 – 22	

entai

entative

#### **Configuration Image**

Each configuration parameter image shown in below figure.



#### 3.4.3 Cyclic transfer

entative

Start cyclic transfer and node join network automatically after correct parameter setting. Refer status monitoring library of Chapter 3.4.5 for status of completing initialize.

Prative

#### 3.4.4 Message transfer

HX-CPU does not support function of user message transfer with FL-net module.

Response only for limited message only received inquiry message from other node.

Detect timeout at request side when requiring message can't be response from other node.

No.	Message	Require	Response
1	Byte block read	NA	NA
2	Byte block write	NA	NA
3	Word block read	NA	NA
4	Word block write	NA	NA
5	Network parameter read	NA	X *1
6	Network parameter write	NA	NA
7	RUN / STOP direction	NA	NA
8	Profile read	NA	NA
9	Communication log data read	NA	X *1
10	Communication log data clear	NA	X *1
11	Return received message	NA	X *1
12	Pass through type message	NA	NA

tive

entai

entative

\*1 FL-net module create response message.

#### 3.4.5 Status monitor library

entative

Function block is available to get each status information of EH-FLN2/3.

3ntative

Store status information of EH-FLN2/3 into dedicated structure FLInfo at the timing of xDone turns TRUE(ON) when xEnable set ON with FL No. of FL-net.

GetFLI	info	
 xEnable BOOL	BOOL xDone	⊢
byFLnum BYTE	BOOL xError	⊢
	FLInfo FLInfo	⊢

#### Detail of FLInfo structure

entative

Member name	Contents		Туре	Remark	]
xInitDone	Node initialization	1: Done 0: Not yet	BOOL		
xParamError	Parameter error	1: Error 0: Normal	BOOL		]
xAdrDuplicated1	Address duplication area1	1: Error 0: Normal	BOOL		
xAdrDuplicated2	Address duplication area2	1: Error 0: Normal	BOOL		
xWaitforRcv	Wait for receiving status		BOOL		
	1: Error(Wait for receiving)	0: Normal			
xTokenWatchdogTime	Timeout of token	1: Error 0: Normal	BOOL		
xNodeDuplicated	Node number duplication	1: Error 0: Normal	BOOL		_
xTokenTimeoutOwnNode	Timeout of own node token	1: Error 0: Normal	BOOL		
xTBN_CBN_BSIZE	TBN, CBN or BSIZE error	1: Error 0: Normal	BOOL		
xCableDisconnect	Disconnect Cable	1: Error 0: Normal	BOOL		
xTokenModeUnmatch	Un-match token mode	1: Error 0: Normal	BOOL		
axLinkFlag	Link Node	1: Joined 0: Not joined	ARRAY[1254]		
			OF BOOL		
axRunStatus	Status flag upper layer (RUN	Status)	ARRAY[1254]		
	1: RUN 0: STOP		OF BOOL		
abErrStatus	Status flag upper layer (STOP	• Status)	ARRAY[1254]		
	0: NORMAL 1: WAR	NING 2:ALARM	OF BYTE		
sMACID	MAC address		STRING (12)	Valid FLN3 only	
wRefCycleAllowed	Allowed refresh cycle time [n	ns]	WORD		
wRefCycleCurrent	Current refresh cycle time (cu	rrent value) [ms]	WORD		
wRefCycleMax	Maximum refresh cycle time	(maximum value) [ms]	WORD		
wRefCycleMin	Minimum refresh cycle time (	(minimum value) [ms]	WORD		]
wMinFrameIntvl	Minimum frame interval [ x 1	00us]	WORD		]
xEthernetStatus	Ethernet status flag	1: Linked 0: Not linked	BOOL	Valid FLN3 only	]
xLinkSpeed	Link speed flag	1: 100Mbps 0: 10Mbps	BOOL	Valid FLN3 only	
xDuplexMode	Duplex mode flag 1: Full du	plex 0: Half duplex	BOOL	Valid FLN3 only	
xSDRAMError	SDRAM error	1: Error 0: Normal	BOOL		
xEEPROMError	EEPROM error	1: Error 0: Normal	BOOL		
xSystemError	System error	1: Error 0: Normal	BOOL		
xFlashError	FLASH error	1: Error 0: Normal	BOOL		
xMPUError	MPU error	1: Error 0: Normal	BOOL		
xSystemRAMError	System RAM error	1: Error 0: Normal	BOOL		
xNodeNumberError	Node number error	1: Error 0: Normal	BOOL		
xLinkAddressError	Link address error	1: Error 0: Normal	BOOL		
					1

#### 3.5. **Profibus Master**

### 3.5.1 Overview

It is possible to use EH-RMP or EH-RMP2 as Profibus master module. Variable used for Profibus master module is declared in Global Variable List (GVL) and can be accessed %M address. Add into GVL by right clicking "Application" shown in below. TVE



### 3.5.2 Configuration of Link Parameter

Open "EH-LNK parameter" display by double clicking EH-LNK on tree and configure "Offset address of writing area (Writing area %MW offset address)" and "Size of writing area (Size of writing area)".

Offset address of writing area

#### Configure start address of Link area. Set 0(zero) for this configuration.

Size of writing area

Configure Output size configured by Sycon EH-RMP:

EH-RMP2: Configure 512 (as fixed value)

#### Caution

Do not configure 0(zero) for Size of writing area. Even if no output module is used and all slaves are input module only, configure dummy value except 0(zero). If 0(zero) is configured, in case of EH-RMP, STATUS LED brinks 4 times. In case of EH-RMP2, configure 512. If value except 512 is configured, STATUS LED brinks 4 times.

7tai

	Parameter	Туре	Value Defau	ilt Value Unit
	LINK area %MW-address	WORD	0	0
EH-LNK I/O Mapping	<ul> <li>Ø Offset address of writing area</li> </ul>	WORD(01023)	0	0
Chabura	Size of writing area	WORD(01024)		0
Information	_	A word	(EIFRIII) ( JI	

enta;

jontativo

Word address Bit address		Hitachi address	Description (EH-RMP)	Description (EH-RMP2)
%MW0	%MX0.0-7,1.0-7	WL0	[X] word	Write area
%MW1	%MX2.0-7,3.0-7	WL1	Write area	(512word)
%MW2	%MX4.0-7,5.0-7	WL2		
8MW [ <b>X</b> ]			-	
			Write area	]
&MW255	%MX510.0-7, 511.0-7	WLFF	Possible to specify	
MW256	%MX512.0-7, 513.0-7	WL100	Not supported by	
			EH-RMP	
&MW511	%MX1022.0-7, 1023.0-7	WL1FF	(256 word)	
%MW512	%MX1024.0-7, 1025.0-7	WL200	Read area	Read area
				(512word)
%MW767	%MX1534.0-7, 1535.0-7	WL2FF		
%MW768	%MX1536.0-7, 1537.0-7	WL300	Not supported by	
			EH-RMP	
%MW1023	%MX2046.0-7, 2047.0-7	WL3FF	(256word)	

entative

entative

· Ontative

Address of reading area (Configuration is not needed.) Read area is assigned automatically shown in below table

# 3.6 General purpose communication

It is possible to do general purpose communication by using Ethernet port or serial port of HX-CPU.



#### 3.6.1 General purpose communication over Ethernet

In order to do general purpose communication over Ethernet (TCP/IP or UDP/IP), prepared Function Block library under NetBaseService library shown in below table is needed. Refer CAA\_NetBaseService.pdf in NetBaseServices library for further information.

inve.

native.

Protocol	Command	Function		
	TCP_Server	TCP server set-up		
	TCP_Connection	TCP server connection establish		
	TCP_Client	TCP client set-up		
TCP/IP	TCP_Write	Write sending data		
	TCP_WriteBuffer	Write buffered sending data		
	TCP_Read	Read receiving data		
	TCP_ReadBuffer	Read buffered receiving data		
	UDP_Peer	Peer set-up		
	UDP_Send	Send UDP data		
UDP/IP	UDP_SendBuffer	Send buffered UDP data		
	UDP_Receive	Receive UDP data		
	UDP_ReceiveBuffer	Receive buffered UDP data		

Table of NetBaseSe	rvices	library		

#### Caution

Regarding to the byte order of networking, it is general to follow Big endian sending from most higher byte. However, it is not big-endian style due to using variable type in program. Therefore, in some case byte data conversion is needed by using dedicated function prepared in SysSocket library.

- · SysSockHtonl (Network byte order conversion from UDINT)
- SysSockHtons (Network byte order conversion from WORD)

Description example in ST language

test\_out1 16#78563412 := NBS.SysSocket.SysSockHtonl (test\_in1 16#12345678 ); Shiative test\_out2 16#3412 := NBS.SysSocket.SysSockHtons(test\_in2 16#1234 );

"tive

enta;

entativo

#### 3.6.2 General purpose communication over serial

In order to do general purpose communication over Serial, prepared Function Block library under SysCom library shown in below table is needed. Refer Application manual (Command reference edition) for further information.

Table of SysCom library
Function
Serial port open
Serial port open / configuration
Serial port close
Serial port configuration
Serial port internal buffer clear
Receiving data (Read)
Sending data (Write)

Shtativ

### Caution

Below functions of SysCom library are not supported by HX-CPU.

Shidike

- SysComGetSettings
- SysComSetTimeout

entative

# Chapter 4 Other functions

#### 4.1 **OPC-UA Server**

HX-CPU supports OPC-UA server functionality. OPC-UA (Unified Architecture) is the newest spcication of OPC based on the technology used for Web service and this is data exchanging opened standard between softwares does not depend on vendors, programming language, operation systems or region. Adaptable scope of OPC-UA is expanding not only PLC, SCADA and HMI but also MES or ERP positioned as upper layer.

Client application established by using OPC-UA standardized Interface, it will be possible to reuse user software system even for different controller vendors of several equipment without a lot of modification.

HX-CPU supports following functionalities as OPC-UA server.

OPC UA Server functionality Figure



Figure Information Models and OPC UA Server Functionality

Several technical documentation are available from OPC Foundation who is Spread promotion group and it can be possible to get them from https://jp.opcfoundation.org/. entative

entative

### (1) Configuration of HX-CPU side

#### Symbol configuration editor

Configure variable accessed by remotely from OPC-UA client application using OPC-US server function on [Symbol configuration] editor.

If [Symbol configuration] is not on device tree, select [Add Object]-[Symbol configuration] by clicking [Application].



Figure [Symbol configuration] editor

### Configuration of Remote accessing variable

List of variable included in Application are shown at [Symbol configuration]. Specify variable can be accessed remotely.



Shiai

#### Figure Specifying Remote access variable

It is possible to change access right of variable can be accessed remotely. Access right can be changed by each click action. Default setting is read & write.



\*Write only is not supported

Enabling OPC UA server function

Atrue Check "Support OPC UA Features" by double clicking "Setting" tab of [Symbol configuration] (It is check status already when it configured during adding [Symbol configuration].)

View - H Build	Settings 👻					
Changed symbol configura	Include Comments in XM	L	pror	iline <mark>c</mark> han	ge	
Symbols 🔽	Support OPC UA features		ite	Туре	Members	Comment
*  Constants	Optimized Layout Enable direct I/O Access	*				
V var_1	<b>N</b> N	2		INT		

Figure Enabling OPC UA server function

It will be possible to access specified variable from OPC UA Client Application by transferring the project to HX-CPU after above configuration and project build operation.

(2) Connecting from OPC UA

Following example shows connecting OPC UA server of HX-CPU from Client Application. Regarding to the operation, follow client application specification.

UA Server	URI :	opc.tcp://192.168.0.1
011 001 101	014.	0pc.tcp.//1/2.100.0.1

Figure Connecting OPC UA server

Make sure what is object of security protecting and take countermeasure for system configuration and operation mentioned security protection as an example by user responsibility.

- Usage of certification function and regular review for program and data should be protected.
- Usage of security function for devices used in network system.
- Connecting protection with unspecified target by usage of specifying function for connecting target.
- Operation management protection by making limitation of key lock of device setting place or user limitation.

#### 4.2 FTP

### 4.2.1 FTP server

File read or write access (uploading / download) of SD card or USB memory mounted on HX-CPU from PC connected Ethernet, due to built-in FTP server function of HX-CPU. Active mode is recommended for FTP client.

TVG



### 4.2.2 FTP server configuration

Configure several parameters related FTP server on [PLC Parameters] of [Device] Configuration window.

unication Settings	Parameter	Туре	Value	Default Value Unit	Description
-	🕮 🗀 LAN				
ations	😟 🔁 NTP				
	🗐 🧰 FTP				
and Restore	FTP server	Enumeration of BYTE	Disable	Disable	Set enable if FTP server function is used
	Port number	Enumeration of BYTE	ETH1	ETH1	Choose port number for FTP server
	Access Media	Enumeration of BYTE	USB memory	USB memory	Choose USB memory or SD card
	🖤 🔮 User Name	STRING	'ftpuser'	'ftpuser'	Enter user name of FTP server
	Password	STRING	'ftpuser'	'ftpuser'	Enter password of FTP server
	Stop switch definition	Enumeration of BYTE	Reset warm	Reset warm	Stop switch definition
ttings	Reset all outputs in STOP	Enumeration of BYTE	Yes	Yes	All outputs are reset in STOP by hardware
	Battery error detection	Enumeration of BYTE	Enable	Enable	Set disable if battery is not used
ell	I/O config error detection	Enumeration of BYTE	Enable	Enable	Set disable to ignore I/O config error in ERR LED and 7-SEG display
	Program up/download by USB memory	Enumeration of BYTE	Disable	Disable	Set enable to use the function of user program to up/download by USB memor
eployment					
eployment					
ation					
ation P server : C	onfigure Enable when to u	ise FTP.			
ation P server : C rt number :	onfigure Enable when to u Select communication por	ise FTP. rt using for FTF	P. (ETH1	/ETH2/ETH	I3)
eployment ation P server : C rt number : cess Media	onfigure Enable when to u Select communication por : Select access target devi	ise FTP. rt using for FTF ce. (USB memo	P. (ETH1 ory/SD c	/ETH2/ETH card)	13)
P server : C rt number : cess Media	onfigure Enable when to u Select communication por : Select access target devi If media is not mounted	ise FTP. rt using for FTF ce. (USB memo	P. (ETH1 ory/SD c	/ETH2/ETH card)	I3)

**User Name**: Configure user name for login. (Byte character alphabet or number less than equal 32 characters)

Small alpha character, number and \_(under score bar) can be accepted, first character can't be number.

entative **Password**: Configure password for login. (Byte alpha character or number 4 to 32 characters)

Usable character is byte character or special character. However, " [ ¥ \$ can't be used. hative

#### 4.2.3 List of FTP commands

entative

Usable command list is shown in below.

Command	Function
ascii	Set file transfer mode to ASCII.
binary	Set file transfer mode to binary.
bye	Disconnect connection between server and exit client.
cd	Change working directory of server.
close	Disconnect connection between server.
delete	Delete specified file of server.
dir	Show detail list of server files and directories.
get	Transfer file of server into local host. [download]
lcd	Change local working directory.
ls	Show list of server files and directory.
mdelete	Delete multiple files of server.
mdir	Transfer detail of multiple files and directories into local file.
mget	Transfer multiple files of server into local host. [Download]
mkdir	Make working directory onto serve.
mls	Transfer several files in the several files and directory into local file.
mput	Transfer specified multiple local file into server. [upload]
open	Connect specified server.
prompt	Switch interactive mode. Toggling mode every sending command.
put	Transfer specified local file into server. [upload]
pwd	Display current working directory of server.
quit	(same as bye)
rename	Rename file name of server.
rmdir	Delete working directory of server.
	4-5

#### 4.2.4 FTP command detail

#### [ascii]

Format: ftp> asci Function: Set file transfer mode to ASCII.

#### [binary]

Format: ftp> binary Function: Set file transfer mode to Binary.

#### [bye]

Format: ftp> bye Function: Exit ftp.

#### [cd]

Format: ftp> cd [directory] Function: Chang remote directory to specified directory by [directory]. It is not possible upper directory from logged in directory. hative

enta

niativ

#### [close]

Format: ftp> close Function: Disconnect connection between FTP server.

#### (delete)

Format: ftp> delete [file] Function: Delete specified file.

#### (dir)

Format: ftp> dir (([directory]) (local file)) Function: Display detail list of server file and directory. Save this list into file by specified [(local file)].

#### [get]

Format: ftp> get [file] ([local file]) Function: Transfer file of server to local. [download] It is possible to specify transferring local file name.

#### [lcd]

Format: ftp> lcd [local directory] Function: Change local working directory.

Tativ

#### (1s)

Format: ftp> ls (([file]) ([local file])) Function: Change local working directory.

### [mdelete]

Format: ftp> mdelete [file 1] ([file 2] …) Function: Delete multiple files of server.

If interactive mode set off by prompt command, all specified files can be deleted without

confirmation.

#### [mdir]

Format: ftp> mdir [file 1] ([file 2] ···) [local file] Function: Transfer multiple files and directories to local file.

#### [mget]

Format: ftp> mget [file 1] ([file 2] ···)

Function: Transfer multiple files of server to local host.

If interactive mode set off by prompt command, all specified files are transferred without confirmation.

#### (mkdir)

Format: ftp> mkdir [directory] Function: Make directory on server.

#### [mls]

Format: ftp> mls [file 1] ([file 2] ...) [local file] Function: Transfer multiple files and directory list to local file.

#### [mput]

Format: ftp> mput [file 1] ([file 2] ···)
Function: Transfer specified files to server.
If interactive mode set off by prompt command, all specified files are transferred without confirmation.

#### [open]

Format: ftp> open [host] Function: Connect server specified IP address or host name.

#### [prompt]

Format: ftp> prompt Function: Change interactive mode. Toggling mode every sending command...

ative

ents

entativ,

#### [put]

Format: ftp> put [local file] ([server file]) Function: Transfer specified file to server. If server file is specified, transfer file with specified file name.

#### [quit]

Format: ftp> quit Function: Exit ftp.

#### [rename]

Format: ftp> rename [file] [new file] Function: Change file name of server.

#### (rmdir)

Format: ftp> rmdir [directory] Function: Delete directory of server.

#### [type]

entativ,

Format: ftp> type Function: Specify current file transfer mode.

Tativ

#### 4.3 Visualization

Visualization function supporting program debugging and monitoring by using visual displaying on Integrated Development Environment HX-CODESYS and Web visualization function (available with HX-CP1H16) by using general Web browser are available on HX-CPU.



Figure Visualization functionalities

### Create visualization object

It is needed to add visualization object onto application to enable visualization. Select [Application]-[Add Object]-[Visualization]. Related visualization object are added device tree.





### Visualization editor

Double click "Visualization" on Device tree. Visualization editor appears.



#### Visualization editor Figure

#### Usage of elements

There are several parts (this after "elements") available to create graphical display in Tool box. Select element to use from Tool box and drag it into Editor window. The element is placed on Editor window and Property window appears.





### Variable Assignment

Assign variable for element by specifying on "Variable" field of "Property". It is also possible to assign variable using in application by Input Assistant.

operties		- <b>4</b>	Input Assistant		Input Assistan	t 🔪 🖈	
Filter 🔹 😼 Sort b	y ▼ 🛃 Sort order ▼ 🗌 Expert		Text search Categories				
roperty	Value		Variables	Reference Application	Type Address Application	Origin 🔺	
Elementname	GenElemInst 1			PLC_PRG	PROGRAM INT		
Type of element	Lamp			# {} BPLog	G 1	11 ing 5	
Position				+ () CAA	Select assign	variable	
х	149			* () DTU	Library	CAA DTUti Extern, 3	
Y	77			* O FILE * S IoConfig_Globals	LDFAFY VAR_GLOBAL	CAA File, 3.5.7.0 (CA	
Width	70			+ () IoStandard + () SysCom	Library Library	JaStandard, 3.5.8.0 ( SysCom, 3.5.5.0 (Sys	
Height	70			<ul> <li>() Util</li> <li>To () VisuElem2DEth</li> </ul>	Library	Ubl, 3.5.7.0 (System)	
Variable				<ul> <li>() VisuElemCamD</li> </ul>	Library	HsuElemCamDisplaye	
Texts	"Variable "			<ul> <li>C) VisuElemsDate</li> <li>❀ {} VisuElemsWinC</li> </ul>	Library Library	VisuElemsDateTime, 3 VisuElemsWinControls	
Tooltip	Variable			* {} VisuElemTextE	Library	VisuElemTextEditor, 3	
State variables			Structured view		1	iter: None	
Invisible		V V			🔽 Insert with arguments	Insert with gamespace prefix	
Background			Dogumentation:			-	
Image	Yellow		Var_1: INT;			-	
			(VAR)				
			10			w.	
						OK Cancel	
			· · · 1 1 · C · ·	.1			
	Г	agure Assignment	ariable for	element			
		4 – 10					



### Well use elements

Display BOOL type variable (Read)

entative



• It is possible to specify tooltip when mouse indicates close object by specifying "Texts"-"Tooltip" of Property. (This is same as other elements.)

• It is possible to set Display/Non-display by specifying "State variables"-"Invisible" of Property. (This is same as other elements.)

		Pro	perties		<b>▼</b> ₽				
Switching BOOL type variable (Write)			✓ Filter •   ▶ Sort by • 2 Sort order • □ Expert						
Lamps/Switches/Bitmans		Pro	operty	Value					
Lamps/Switches/Ditmaps		Elementname		GenElemInst_4					
			Type of element	Push swit	ch				
		-	Position						
			Х	131					
			Y	178					
PushSwitch		Width		70	Specifying corresponding varia	ling variable			
			Height	70					
Display example			Variable						
	25		Element behavior	Image to	ggler				
			Texts						
			Tooltip						
	1	-	State variables						
			Invisible						
I G I	ſ		Deactivate inputs						
In case of In case	IC	Background							
[FALSE] [TRUE			Image	Gray					

• It is possible to specify element behavior at "Element behavior" of Property. Image toggle: Toggle switch behavior. It turns ON by click once and Turns OFF by one more click. Image tapper: Push switch behavior. It turns ON during click only.

• It is also possible to untenable operation by specified variable value by setting "State variables"-"Deactivate inputs" of Property.

Refer on-line help for further detail of each element specifications.





#### Task configuration of Visualization

"VISU\_TASK" is added automatically by adding Visualization object.

Device (HX-CP1H16) H) PLC Logic Application Library Manager PLC_PRG (PRG) HXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	VISU_TASK X Configuration Prionity ( 0.31 ): 31 Type Cycle Interval (e.g. t#200ms): 100 Watchdog Enable	
MainTask PLC_PRG  VISU_TASK VisuElems.Visu_Prg Visualization Manager	Time (e.g. t#200ms): Sensitivity: Add Call X Remove Call Chance Call A Move Up A Move Down (***)Open POU	
WebVisualization  Sac (Basic)	POU Comment ViauElems: Viau_Prg	

Figure Task configuration of Visualization

#### Configuration items of Visualization Task

Priority(0,31)	Configure task priority of visualization task. 0(zero) is the highest priority. To avoid impact
	control program operation, the lowest priority is recommended for this configuration.
Туре	Cyclic: Refresh data according to the specified constant cycle. (Default is 100 msec)
	Event: Refresh by specified condition. It is possible to use specified variable by Input Assistant.
	Freewheeling: Refresh data by using idle (free) time of each task.
	Status: Refresh by specified condition. It is possible to use specified variable by Input Assistant.

#### Visualization manager

This is common configuration items for Visualization and Web Visualization.

Devices 👻 🕂 🗙	🕸 VISU_TASK 🏹 WebVisualization 🖓 Visualization Manager 🗙	· ·
Project	🖶 Settings 🔲 Default Hotkeys 🕮 Visualizations 🤗 User management	
Device (HX-CP 1H16)		-
		Settings for user management
Library Manager	Use unicode strings	Logindialog
	Use CurrentVisu variable	characterized distance
Task Configuration		Change password dialog
🗟 🍪 MainTask	Style settings	Change configuration dialog
PLC_PRG	Selected style: Basic style, 3.5.8.0 (3S-Smart Software Solutions GmbH)	
🖃 🍪 VISU_TASK	Display all versions (for experts only)	Additional settings
VisuElems Visu_Pro	Preview:	C Activate multitouch handlir
📮 🛃 Visualization Manager	Button	Activate semi-transparent
CB WebVisualization	Radiobutton	
Usualization		I Activate standard keyboar
Basic (Basic)	C Radiobutton	Extended settings
		Visible
	Language settings	
	Selected language:	
	Cabling of face default based instead	
	4	
<u>ا ا</u>		
	Figure Configuration of Visualization manager	
	4 – 14	

Configuration	
🕒 Settings 🗔 Default H	otkeys   🖶 Visualizations   😫 User management   😭 Font settings
General setting	65.
General settings	
UseUnicodestrings	
Use CurrentVisu Variabl	a
Use Unicodestrings	All string is executed by Unicode format used in Visualization by this option.
	If Japanese character is displayed for Web visualization, please check this.
User CurrentVisu Variable	Pass name of current display visualization to Global string variable "CurrentVisu".

Style settings : (Use this default value without change)

Style settings	
Selected style:	Basic style, 3.5.8.0 (3S-Smart Software Solutions GmbH) $\checkmark$
	Display all versions (for experts only)
Preview:	Button - Headline
	Radiobutton
	20 20
anguage settings	
Language settings	
Selected language:	
onfigured languag	e will be used at the time of start.
888	
	4 – 15

etting for default test input	
Settings for default text input	
lumpad	VisuDialogs.Numpad V
Ceypad	VisuDialogs.Keypad $\checkmark$
Use text input with limits	VisuDialogs.TextinputWithLimits
in the second second	
se text input with limits Defau	all of text input is dialog with the minimum and maximum value range.
er Management of Visualization	
Settings Default Hotkeys	Visualization
onfigure access limitation for securi	ity protection is possible for Visualization.
efer "4.7 Support function of securit	ty protection".
Upload and download or	peration User login without access Monitoring and operation
Upload and download op of the project with pas	peration User login without access Monitoring and operation ssword right is prohibited without access right are
Upload and download op of the project with pas protection is prohib	peration User login without access Monitoring and operation ssword right is prohibited without access right are prohibited
Upload and download op of the project with pas protection is prohib	peration User login without access Monitoring and operation ssword right is prohibited without access right are prohibited
Upload and download op of the project with pas protection is prohib PC	peration ssword bited User login without access right is prohibited PC
Upload and download op of the project with pas protection is prohib PC	peration ssword bited User login without access right is prohibited PC PC
Upload and download op of the project with pas protection is prohib PC	peration seword ited User login without access right is prohibited PC PC PC
Upload and download op of the project with pas protection is prohib PC	peration ssword bited User login without access right is prohibited PC PC PC X
Upload and download op of the project with pas protection is prohib PC	peration ssword bited User login without access right is prohibited PC PC PC V V V
Upload and download op of the project with pas protection is prohib PC	peration seword ited User login without access right is prohibited PC PC PC V V V
Upload and download of of the project with pas protection is prohib PC C	peration ssword bited User login without access right is prohibited PC PC PC C C C C C C C C C C C C C C C
Upload and download or of the project with pas protection is prohib PC	peration seword inted PC PC PC PC PC PC PC PC PC PC
Upload and download of of the project with pas protection is prohib PC	peration seword ited PC PC PC PC PC PC PC PC PC PC
Upload and download of of the project with pass protection is prohib PC CONTROL OF THE HILL Fi	peration seword inted PC PC PC PC PC PC PC PC PC PC
Upload and download of of the project with pas protection is prohib PC C C C C C C C C C C C C C C C C C C	peration sword ited PC PC PC PC PC PC PC PC PC PC
Upload and download of of the project with pas protection is prohib PC CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	peration sword       User login without access right is prohibited       Monitoring and operation without access right are prohibited         PC       PC       PC         PC </td
Upload and download of of the project with pas protection is prohib PC C C C C C C C C C C C C C C C C C C	peration sword inter prohibited PC PC PC PC PC PC PC PC PC PC PC PC PC
Upload and download of of the project with pas protection is prohib PC CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	peration swordUser login without access right is prohibitedMonitoring and operation without access right are prohibitedPC<

entative Visualization starts automatically when status of HX-CPU is set to RUN. Phatika

#### Web Visualization

It is possible to access Visualization stored in HX-CPU from general Web browser of PC or tablet. This function is called Web Visualization.

Use Web browser following HTML5 . (Example: Firefox, Chrome, IE9 or later, etc)

Web Visualization can be used during HX-CPU is in RUN status.

#### Caution

Web Visualization of HX-CP1S08 operates. However this is only demonstration purpose. Therefore please do not use Web Visualization of HX-CP1S08. Display is limited within 30 minutes.

Add client object of Web Visualization under "Visualization Manager" on Device tree.

#### [Application]-[Visualization Manager]-[Add Object]-[Web Visualization]

Project  Project Proje	Add WebVisualiz	ation X web visualization client
Project         Project         Puc Logic         PLC_PRG (PRG)         PLC_PRG (PRG)         Task Configuration         PLC_PRG         VISU_TASK         VISU_TASK         VISU_TASK         VISU_Elems.Visu_Prg         VISUalization         VISUalization         Basic (Basic)	WebVisualization         Start-Visualization:         Name of .htm file:         Updaterate (ms):         Default communication buffer size:         Scaling options         C       Fixed         Scaling options         C       Fixed         Client width:         Client height:         Presentation options         Iv         Antialiased drawing         Default text input         Input with:	Add Cancel

Figure Web Visualization Object

If Webvisualization Object configuration display is not displayed on right side, it will appears by double clicking "Webvaisualization" object.

Configuration items of we	dvisualization object
Start • Visualization	Input Visualization name when starts Visualization at the time of start automatically.
File name of .htm	Specify HTML file name of Visualization.
	Usable character for file name is byte alpha or number. File name including Japanese
	character can't be monitored by browser.
Refresh cycle(ms)	Specify refresh cycle in ms units for Web browser. (Default is 200ms)
Default communication	Specify communication buffer size between browser.
buffer size	
Automatic adjustment	
	Fixed: Display original size when it is made.
	Isotropic: Ratio of image is kept and displayed.
	Anisotropic: Display according to Browser display size after adjusted automatically.
Width of client	Specify window width size of browser (Pixel)
Height of client	Specify window height size of browser (Pixel)
プレゼンテーション選択	
	Check when it needed to display in Visualization Editor of programming system.
Default text input	
Touch screen	Select when Touch screen is used for Web client.
Keyboard	Select Keyboard is used for Web client.

#### Access method from Web browser

Describe URL following below description to access downloaded Visualization of HX-CPU from Web browser. http://[IP address]:[8080]/[Web file name] Example : http://192.168.0.1:8080/webvisu.htm

Following display appears after completing access to HX-XPU, and Display of Visualization spears.



This display appears when HX-CPU is stopping or Visualization is under preparation. Specified Visualization appears after HX-CPU is in running and preparation is completed.

User name and password are required when on-line user is registered HX-CPU. Regarding to user name and password, please contact management person of your HX-CPU.



Left display appears by press [Cancel]

Method of Visualization file deleting

Visualization file registered in HX-CPU, this file is registered dedicated Visu folder inside of HC-CPU.

If Visualization file name is changed, the file having previous name is still remain and remaining free area of folder is shorted, "File Transfer Error" will appear. It is possible to clear inside of Visu folder by reset(PLC initialize)

Philativa



Refer on-line help for further detail of each element specifications. entative

#### Caution for Visualization using

Make sure what is object of security protecting and take countermeasure for system configuration and operation mentioned security protection as an example by user responsibility.

- Usage of certification function and regular review for program and data should be protected.
- Usage of security function for devices used in network system.

entative

entative

• Connecting protection with unspecified target by usage of specifying function for connecting target.

entative

• Operation management protection by making limitation of key lock of device setting place or user limitation.

entative

entai

jentativo

# 4.4 Calendar clock function

HX-CPU includes Calendar clock IC, Clock data can be used in program as system clock. Use this function by setting system clock and time zone information. Configure clock data by dedicated function block (CAA DTUtil library). Refer "System clock command" of HX Application Manual [Command reference edition] for further detail.

	List of CAA DTUtil library
Command	Function
GetDateAndTime	Get system clock
SetDateAndTime	Set system clock
GetTimeZoneInfomation	Get time zone information
SetTimeZoneInfomation	Set time zone information

#### Time zone

There are two type of time zone in HX-CPU. Use Clock function by setting same information for both two time zone,

Time zone Configure method		Target
Time zone 1	Function block (SetTimeZoneInfomation)	GetTimeZoneInfomation
Time zone 2	Configuration (PLC Parameters)	GetNTPStatus

#### Caution

Maximum system clock data of HX-CPU is 2038 January 19<sup>th</sup> 03:14:17. Configure and manage of clock data not to exceed maximum data due to exceeding maximum value operation may not be correct.

Here is example program to restart from 2000 January 1<sup>st</sup> 00:00:00 automatically if clock data exceed 2037 December 31<sup>st</sup> 23:59:59. Use this example program by modifying according to the system specification. Configure NTP Client function invalid, if following example program.

Declaration part of variable.

```
PROGRAM POU
VAR
BLINK_0: BLINK;
GetDateAndTime_0: DTU.GetDateAndTime;
SetDateAndTime_0: DTU.SetDateAndTime;
GET_TIME_ERROR: BOOL;
SET_TIME_ERROR: BOOL;
END_VAR
```

TIV

#### Program

## 4.5 NTP client function

SNTP client function getting clock information from NTP (Network Time Protocol) of network is available with HX-CPU.

It is also possible to set clock information of HX-CPU Calendar Clock IC by getting clock information from NTP server. Get clock information when start RUN, it can be possible to set 1 minute to 1440 minute (24 hours) interval and to get clock information by specified cycle.



NTP Client function

#### Specification of NTP client

Items	Specification
Communication protocol	SNTP (Simple Network Time Protocol)
Getting cycle	Start RUN timing, User configuration (00:01-24:00)
Collected clock data	Year / Month and date / Day / Hour / minute / second
	(data type: DATE_AND_TIME)
Refresh getting interval	Refresh by calendar time clock IC

It is possible to get NTP status by using dedicated function block (GetNTPstatus). ExecNormal of GetNTPstatus turn TRUE by getting clock data correctly, therefore if clock data is used in user program, use it after confirming ExecNormal of GetNTPstatus turns TRUE.

#### Caution

entative

If NTP client function is used, use it after setting time zone. Configuration is done by dedicated function block (SetTimeZoneInformatio). Refer "System clock command" of HX Application Manual [Command Reference Edition] for further detail information.

entative

ntative

#### **Configuration Method**

"Device" window appears after selecting "Edit Object" by double clicking or right clicking "Device (HX-CP...)" on Device tree. Select items of "NTP" by double clicking "PLC Parameter" tab.



Parameter	Туре	Value	Default Value	Unit	Description
🗄 😳 LAN					
=··· 🚰 NTP					
🖤 🖗 NTP function	Enumeration of BYTE	Disable	Disable		Time data is taken from NTP server and written on RTC
🖤 🖗 Port number	Enumeration of BYTE	ETH1	ETH1		Choose port number for NTP server
🖤 🖗 Logical port number	STRING	'123'	'123'		Logical port number
🖤 🖗 Specified by	Enumeration of BYTE	IP address	IP address		Choose IP address or Host name to specify NTP server
IP address or Host name	STRING	'0.0.0'	'0.0.0.0'		Enter IP address or Host name
🖤 🖗 Access cycle	WORD(11440)	60	60	min.	Set time to access NTP server
🖤 🌵 Timeout	BYTE(1255)	10	10	sec.	Set timeout value
🖤 🖗 TimeZone	Enumeration of BYTE	υтс	UTC		Time difference to UTC
- 泣 FTP					
Stop switch definition	Enumeration of BYTE	Reset warm	Reset warm		Stop switch definition
Reset all outputs in STOP	Enumeration of BYTE	Yes	Yes		All outputs are reset in STOP by hardware
Battery error detection	Enumeration of BYTE	Enable	Enable		Set enable if battery is used
I/O config error detection	Enumeration of BYTE	Enable	Enable		Set disable to ignore I/O config error in ERR LED and 7
Program up/download by USB memory	Enumeration of BYTE	Disable	Disable		Set enable to use the function of user program to up/d

#### Configuration Items of NTP client

Item name	Contents	Setting range	
NTP server	Select valid or invalid getting clock information from NTP server.	Disable / Enable	
Port number	Select communication port getting clock information.	ETH1 / ETH2 / ETH3	
Logical port number	Set port number using for NTP server connection.	123	
	21.	(Changing number is not required in general)	
NTP server definition	Select specifying method of NTP server.	IP address (Fixed IP address)	
NTP server IP or host name	Specify NTP server.	XXX.XXX.XXX.XXX	
Access cycle	Set time interval of clock information.	1-1440 (unit: minute)	
Timeout	Set detecting time of timeout.	1-255 (unit: second)	
TimeZone	Specify time zone.	UTC-12:00-UTC+12:00	
	4 – 23		
#### 4.6 Removable media

HX-CPU supports USB memory and SD card (HX-CP1H16) as removable media and file access is possible. Here is sample program description executing data logging on removable media by using CAA File.

This sample program is 3 kinds data (time stamping, dummy data, text) logging making CSV file (File name: LoggingSample.csv) on USB memory. New data is added every 10 seconds automatically. Modify data writing timing in ve according system usage.

	A	В	С
1			
2	DT#2016-05-17-21:25:22	1	This is Test !
3	DT#2016-05-17-21:25:32	2	This is Test !
4	DT#2016-05-17-21:25:42	3	This is Test !
5	DT#2016-05-17-21:25:52	- 4	This is Test !
6	DT#2016-05-17-21:26:02	5	This is Test !
- 7 -	DT#2016-05-17-21:26:13	6	This is Test !

#### Declaration of variable

VAR	RAM PLC_PRG	
	USBMountSts	: B00L;
	SDMountSts	: BOOL;
	sDirSD	: SIRING := /media/sd-mmcblkUp1'; // SD card
	sDirUSB	: SIRING :='/media/usb-sda1'; // USB memory
	sFileName	: CAA. FILENAME;
	FileOpen	: File.Open;
	FileClose	: File.Close;
	FileWrite	: File.Write;
	FileFlush	: FILE. Flush;
	sMedia	: STRING;
	iState	: UINT :=1;
	hfile	: CAA. HANDLE;
	sWriteLine	: STRING(128);
	GetRTC	: DTU. GetDateAndTime;
	×RDRTC	: BOOL;
	xReadDone	: BOOL;
	dtTemp	: DATE_AND_TIME;
	sDT	: STRING;
	T1	: TON;
	FileOpenDone	: BOOL;
	File0penErr	: BOOL;
	FileWriteDone	: BOOL;
	FileWriteErr	: BOOL;
	FileFlushDone	: B00L;
	FileFlushErr	: B00L;
	Err	: B00L;
	Exclsv	: B00L;
	iNum	: INT;
	sNum	: STRING;
END	VAR	,

Tative

```
Program
  USBMountSTS:=UsbMountStatus();
  IF USBMountSTS=FALSE THEN
     RETURN;
  END IF
  //SDMountSts:=UsbMountStatus();
                                            Enable these when logging data on
  //IF SDMountSTS=FALSE THEN
             RETURN;
                                            SD card.
  //END_IF
  CASE iState OF
             1:
             sMedia := sDirSD; // SD card
             sMedia := sDirUSB; // USB memory
             sFileName :='/LoggingSample.csv';
             sFileName := CONCAT(sMedia, sFileName);
             iState := 2:
             2: // FileOpen: Mode. MWRITE
                       FileOpen (xExecute:=TRUE, sFileName:=sFileName, xExclusive:=Exclsv, eFileMode:=File.MODE.MWRITE);
                       IF FileOpen. xDone = TRUE THEN
                                  FileOpenDone:=TRUE;
                                  hfile:=FileOpen.hFile;
                                  FileOpen(xExecute:=FALSE);
                                  xRDRTC := TRUE;
                                  iState:=10;
                                  ELSIF FileOpen. xError=TRUE THEN
                                  FileOpenErr:=TRUE;
                                  FileOpen(xExecute:=FALSE);
                                  iState:=90:
                       END IF
             3: // FileOpen Mode. MAPPD
                       FileOpen(xExecute:=TRUE, sFileName:=sFileName, xExclusive:=Exclsv, eFileMode:= File.MODE.MAPPD);
                       IF FileOpen. xDone = TRUE THEN
                                  iState:=10;
                                  hfile:=FileOpen.hFile;
                                  FileOpen(xExecute:=FALSE);
                                  xRDRTC := TRUE;
                       ELSIF FileOpen. xError=TRUE THEN
                                  FileOpen(xExecute:=FALSE);
                                  iState:=90;
                       END IF
             10: // Get RTC data
                       GetRTC(xExecute:=xRDRTC, xDone=>xReadDone, dtDateAndTime=>dtTemp);
                        IF xReadDone=TRUE THEN
                                  sDT:=DT_T0_STRING (dtTemp);
                                  GetRTC(xExecute:=FALSE);
                                  iState:=11;
                       END_IF
             11: // Create & Combine the data
                       iNum := iNum +1;
                       sNum := INT_TO_STRING(iNum);
                       sWriteLine := CONCAT('$r$n', sDT);
                       sWriteLine := CONCAT(sWriteLine, ', ');
                       sWriteLine := CONCAT(sWriteLine, sNum);
                       sWriteLine := CONCAT(sWriteLine, ', ');
                       sWriteLine := CONCAT(sWriteLine, 'This is Test ! ');
                       iState:=12;
```

```
12: // FileWrite
                     FileWrite(xExecute:=TRUE, hFile:=hfile, pBuffer:=ADR(sWriteLine),
                                szSize:=INT_T0_UDINT(LEN(sWriteLine)));
                     IF FileWrite.xDone = TRUE THEN
                        FileWrite(xExecute:= FALSE);
                        FileWriteDone:=TRUE;
                        iState:=20;
                                          // To Flush
                     ELSIF FileWrite.xError = TRUE THEN
                                FileWriteErr:=TRUE;
                                FileWrite(xExecute:= FALSE);
                                iState:=90;
                     END_IF
                                xRDRTC := FALSE;
          20: // FileFlush
                     FileFlush(xExecute:= TRUE, hFile:= hfile);
                     IF FileFlush. xDone = TRUE THEN
                        FileFlush(xExecute:= FALSE):
                        FileFlushDone:=TRUE;
                        iState:=30;
                                          // Close that file
                     ELSIF FileWrite.xError = TRUE THEN
                        FileFlushErr:=TRUE;
                        FileFlush(xExecute:= FALSE);
                        iState:=90;
                     END_IF
          30: // Close that file.
                     FileClose(xExecute:= TRUE, hFile:= hfile);
                     IF FileClose. xDone = TRUE THEN
                        iState := 40;
                        FileClose (xExecute:= FALSE);
                     ELSIF FileClose. xError = TRUE THEN
                        FileClose (xExecute:= FALSE);
                        IState := 90;
                     END IF
          40: // wait 10 seconds
                     T1 (IN:=TRUE, PT:=T#10S);
                     IF t1.Q THEN
                                iState:=3:
                                T1 (IN:=FALSE);
                     END IF
          90: // Error
                     Err:= TRUE; // Error
END_CASE;
```

#### Caution

- Access files after confirming USB memory mounting status or SD card mounting status by program when access files of USB memory or SD card. SdMountStatus command and UsbMountStatus command are prepared to get mounting status.

- Don't remove USB memory or SD card during accessing file or directory. It will be cause can't access again. If USB memory or SD card needed to be removed during PLC is in RUN status, removing action like SD card switch pressing and execution of UsbUnmount command required after executing Flush/close command. It is convenient to execute by prepared input variable for invoking UsbUnmount command.

- It may take long time for file accessing time depends on USB memory or SD card type. It is recommended to separate file access task and general I/O access task.

- There are some possibility to access file of USB memory or SD card not only from CAA File but also from FTP client etc at same timing. To avoid this situation, exclusive file access control is required.

## 4.7 Supporting function for security protection

Supporting function for Security protection protecting illegal access is available on HX-CPU to prepare external security risk via network accessing. Use this supporting function as one of method to keep needed security level for system.



Figure Supporting function for security protection via network access

#### Limitation of on-line user

It is possible to limit user on-line connecting HX-CPU. Only the registered user can login HX-CPU by registering name and password. This is same as for Visualization or Web Visualization.

#### [Online]-[Security]-[Add On-line user]

Online         Debug         Tools         Window         Help           Login         Alt+F8           Loggut         Ctrl+F8           Greate boot application	■ ペI印 역 역 10 3 1 0 1 m 幹 1日 初 路 前 唱 唱 唱 愛 ManTask	ialog of Add Online user
Download Online Cha <u>n</u> ge	Add Online U	lser X
Source download to connected device	Name:	hitachi
Multiple Download		
<u>R</u> eset warm Res <u>e</u> t cold Rese <u>t</u> origin	Password: Confirm pass	sword:
Simulation		Hide password
Security	Logoff current online user     Password str	reports:
Operating Mode	Strong Stro	
	Remove Online User     Ghange Password Online User	OK Cancel

Figure 2.24.2 Add on-line user

Following dialog appears at login after registering on-line user. Input registered name and password.

Device User Logon		×
You are currently Please enter the the sufficient righ	not authorized to perform this operation on the device name and password of an user account which has got ts.	
Device Name:	Device (HX-CP1H16)	
Device Address:		
User Name:		
Password:		

	0_0		
🔁 🛞 🥌 http://192.168.0.1:8080, 🔎 + C	遵 192.168.0.1		
Usernama:	_		
Password:			
Ok Cancel	1	_	
OK Odričel	1		
Looding Wohvisualizati	on		

at Wah visualization assass

)iai

Figure Access of HX-CPU registered on-line user

Dialog at login appears again when user name or password is different from registered. Confirm user name and password with manager registered on-line user when login can't be possible.

#### It is recommended like in below not to image easily.

Length of password more than equal 8 characters (Most suitable is 12 characters or more)

Mixture capital letter and small letter

Mixture number

Mixture special character

Avoid existing name or easily guessed phrase for password ("123", "abc" or "qwerty" etc)

Caution !

Login with empty user name and password can't be used after adding new user with this procedure. Please make note registered password without missing.

Registered user can delete on-line user registration after logon. If not to use dialog at login, add new user with name 'Everyone' and empty password. It is possible login without login dialog from next login.

ativ.

entai

entative

#### Caution

entative

Be careful, on-line user is deleted by "Device reset (initialize PLC)" operation.

Shiative

#### Password protection of Project

Password protection is possible for project file.

This protection is valid when open stored file or open uploaded stored source program in HX-CPU by HX-CODESYS.

Open dialog of [Project]-[Project Settings]-[Security].

Proj	ect Visualization <u>B</u> uild O	2				
1010	<u>A</u> dd Object					
6	Add Eolder					
	Scan For Devices	P	roject Settings		X	
	Update Device		Compile options	Security		
ß	<u>E</u> dit Object		Compiler warnings Page Setup	Enable project file encryption		
	Edit Object With		B Security	O Password O Dongle		
20	Online <u>⊂</u> onfig Mode…		SFC Source Download			
	Set Active Application		§ Static Analysis Light			
i	Project Information		Visualization			
0	Project Settings		Visualization Profile			
	Project Environment					
6	Document					
D	Compare					
	Export					
	Import					
	Export PLCopenXML		7			
	Import PLCopenXML				OK Cancel	
	User Management					
-			Figure Configure	ration of Drojact password		
			Figure Configur	ration of Project password		

Select "Password" by check on "Enable Coding of Project file".

Input current password, new password and new password confirming.

roject Settings	
Compile options Compiler warnings Page Setup: Securty Src Source Download Static Analysis Light Users and Groups Visualization Visualization Profile	Security  Cassword Oponje  Tritise option is activated, a password is used to encrypt the content of the currently open of the content of the currently open of the isolated as library reference.  Tryout forget the encryption password, your project file will be lost it is not possible to restore the file contents in this case!  Current password:  Current password:  Confirm new password:
	OK Cancel

Figure Input Project password

This after, protection is enabled when to open stored file or to open uploaded source program stored in HX-CPU. 以降、保存したファイルを開くときや、HX-CPU に格納されたソースプログラムをアップロードして HX-CODESYS で開く場合の保護となります。

At the time to open project or uploading	In case of
Encryption Password X	CODESYS
Enter the password for 'testpw.project':	

Cancel

$\otimes$	The password for the encrypted project 'pw' is not correct

password is not correct

#### Figure Input Project Password

Caution !

FI

Project can't be opened if forgetting coding password. Please be careful not to forget password and manage it.

#### Access limitation of Visualization

It is possible to make access limitation for Visualization page or Display element.

Configure access right for each group by registering user and group belonging its user.





#### User management of Visualization 🖃 🍙 testpw 🖹 🕤 Device (HX-CP1H16) PLC Logic 😑 🔘 Application 👘 Library Manager 🖶 Settings 🔲 Default Hotkeys 🖶 Visualizatio 🗧 😫 User management Font setting: PLC\_PRG (PRG) Task Configuration Create user management with default groups and users 14 Create empty user 🆃 MainTask PLC\_PRG 🗳 VISU\_TASK VisuElems.Visu\_Pr This window is displayed when no user management data Visualization Man Double clicking 😸 📳 Visualization 🗄 📊 Basic (Basic) Figure Visualization manager

There is no user management data as default setting. Click "Create user management with default groups and users" in order to register user management group and user.

📳 Settings	Default Hotkeys	Visualizations	😫 User management	😭 Font settings
Create	empty user	Create user manage	ment with	
mar	nagement	default groups an	d users	

Configuration of Group and User is default setting in below. At this default setting, user belongs to Group "Admin" are configured having right of data changing.

Group name	Automatic logout	Logout time	Permission to change user data	Description	ld
± 😫 Admin		1 minute(s)			1
🛚 🤮 Service		1 minute(s)			2
± 🤮 Operator		1 minute(s)			3
😫 None					
		1 minute(s)			

jentative



#### Configure "Access rights" on the property window of element.

entative

User name to password are same at default setting Figure 2.24.9 User management Visual	ization manager
Next is explanation of Element configuration of Visualization.	
Configure "Access rights" on the property window of element.	
Yisualization X & MainTask PLC PRG Visualization Manager	▼ Properties ▼ ₽
Interface Editor 🔲 Hotkeys Configuration 🧱 Elementlist	V Filter ▼ V Sort by ▼ A Sort order ▼ V Expert
1 VAR_IN_OUT	Property Value
	Elementname GenElemInst 2
3 ERD_VAR	Type of element Dip switch
	🖃 Position
	× 56
	Y 155
	Width 70
0.0 20.0 40.0 60.0 80.0 100.0	Height 70
	Variable PLC_PRG.Var_1
	Element behavior Image toggler
	= Texts
	Tooltip
	+ State variables
	+ Background
Dedicated property window appears by selecting "Element"	
<	> Properties X ToolBox
((人 1, 2) 古, ) () 古	
Access rights 1/1 / K/	
Access rights X Doub	ole clicking
User groups operable only visible invisible Admin V I I Service V I Solution V I None V I Service I V I S	10 2
Configure other	than user of Group "Admin" can't operate.
Group hierarchy is activated OK Cancel	

Figure Access right configuration for element of Visualization

# 🕂 Caution

In the control system, recently, the connection and cooperation with the information communication system progress and information security risks including cyber attacks are growing. In a system applying this product, physical security measures mainly in the installation location and security measures in use via network are needed.

[Security risk example via the network]

- Abnormal operation, performance degradation, information leakage and data tampering by attacks from outside

- Malfunction, harm and damage occurrence due to programs and/or data tampering from outside
- It is used as an attacking step for the-other systems

Hitachi Group is striving security improvement of control systems by establishing prerequisite protecting target defined for each product and equipping security protection functions under the own provision security design procedure.

In order to deal with the security risks from the outside via the network, this product is equipped with a security protection support functions for the purpose of prevention of unauthorized access. However, the security level to be determined by the control system. In addition, the assumed security risk is not fixed, it will be something to change on a daily basis.

Not only in our products, individual security protection support functions of each product configuring the system is one means to ensure the security level required for the system, it does not completely prevent the security risk growing daily.

The construction of the security level required for the control systems are responsible by the system and customer. In addition, for the maintenance of the security level will require continuous improvement measures.

In a system using this product, regardless of the presence or absence of the use of security protection support functions, trouble, accident or damages caused by unauthorized external access, Hitachi Group will not be able to bear any responsibility.

It is required for the customer side to clarify the target of the security protection of the system, following the conduct measures example to a representative, please refer to the construction and operation of the system.

- -Utilization and regular review of the authentication function for the program and the data to be protected
- -Utilize the security functions of the device configuring the network

entative

- -Prevention of the unspecified connection by the use of a particular function to identify connection
- -Measures in the operational management, such as to lock the location of devices or limit the operator.

entativ,

# Chapter 5 Debugging function

It is possible to debug program by using HX-CODESYS. In this chapter, following debug functions are explained.

No.	Functions	Refer page
1	Monitor function	5.2
2	Flow control function	5.3
3	Break point function	5.4
4	Single cycle, Step execution function	5.5
5	Set value fourthly, write value function	5.6
6	Trace function	5.7

VR

entai

entative

There are two methods, one is on-line debug done by connecting with HX-CPU, the other is off-line debug executing simulation on HX-CODESYS.

## 5.1 How to start

Even it is same operation of debug operation between on-line debug and off-line debug, starting operation is different. Each method how to start are described in below.

#### How to start off-line debug

Login and start execution.

#### How to start simulation

Click "Simulation" of "On-line" menu. Login and start execution.

Onli	ne	Debug	<u>T</u> ools	Window	<u>H</u> elp			
CŞ.	Lo	gin			Alt+F8			
04	Lo	gout			Ctrl+F8			
	Cr	eate <u>b</u> oo	t applica	tion				
	D	wnload						
	0	hline <u>C</u> har	nge:					
	≦c	ource dow	nload to	connected	device			
	M	Multiple Download						
	Re	<u>R</u> eset warm						
	Re	es <u>e</u> t cold						
	Re	ese <u>t</u> origin	1					
	Sir	mulation						
	Se	curity			3			
	O	perating N	1ode		I			

entative

#### 5.2 Monitor function

Monitor function is to monitor contact, coil and current value of variable and it is possible to monitor variable declaration part, LD (Ladder diagram logic) display part, FDB (Function Block Diagram) part, ST (Structured Text) display part etc.

Declaration variable part

art etc. on variable part	(AL)
In variable part  It ladder_1 x  Device.Application.ladder_1  Expression Type Value Prepared value Address Comment	
Image: Second	
Image: State of the state	
Image: The second se	
Device_Application.ladder_1           Expression         Type         Value         Prepared value         Address         Comment	
Expression Type Value Prepared value Address Comment	
🖗 var1 BOOL TRUE	
🔷 var2 BOOL FALSE	
var3 BOOL FALSE	
Var4 BOOL TRUE	
🖗 var5 TIME T#400ms	

	121.
Display	Contents
TRUE	Show variable is ON.
FALSE	Show variable is OFF.
T#400ms	Show value of variable. This shows value of var5 is 400ms.

#### Ladder diagram



Display	Contents	
varl	Show contact is ON.	-nr-
var2	Show contact is OFF.	·9/
var4	Show coil is ON.	
var3	Show coil is OFF.	
T#400ms	Show value of var5 is 400ms.	04.
	5 – 2	
	Display var1 var2 var4 var4 var4 T#400ms	DisplayContentsvar1Show contact is ON.var2Show contact is OFF.var4Show coil is ON.var3Show coil is OFF.T#400msShow value of var5 is 400ms.5-2

191

jentativo



1 TON\_0 (IN TRUE := var1 TRUE 2 T#500ms :=T#500MS, PT 3 ET =>var5 T#380ms 4 (FALSE => var6 FALSE ); var4 TRUE :=var1 TRUE ; 5 6 0 var3 FALSE := var6 FALSE AND var2 FALSE ; RETURN

Display	Contents	
TRUE	Show variable is ON.	
FALSE	Show variable if OFF.	
T#500	Show value of variable.	
1#JUUMS	This shows value of var5 is 500ms.	

entative

#### Change display mode

It is possible to change display for variable monitor with binary, decimal or hexadecimal. Select "Debug"-"Display mode". 7tative



l'ative

#### Binary display

PLC_PRG X						•
Device.Application.PLC_PRG						
Expression	Туре	Value	Prepared value	Address	Comment	N.
🖗 var1	INT	2#0000010011010010				
var2	INT	2#0001011000101110				
< var3	INT	2#0001101100000000				
1 var1 2#0000010011010010 := 1234;						<b>_</b>
2 var2 2#0001011000101110 := 5678;			_			=
3 var3 2#0001101100000000 := var1	2#0000010011010010	+ var2 2#0001011000101110	;			
4						
5						
cimal display						

### Decimal display

PLC_PRG X							
Device.Application.PLC_PRG							
Expression	Туре	Value	Prepared value	Address	Comment	Þ	
🖗 var1	INT	1234					
var2	INT	5678					
< var3	INT	6912					
1 _ var1 1224 - 1	23/ •						

2 • var2 5678 := 5678;

var3 6912 := var1 1234 + var2 5678 ;

#### Hexadecimal display

3

5

PLC_PRG X						•
Device.Application.PLC_PRG						
Expression	Туре	Value	Prepared value	Address	Comment	N
var1	INT	16#04D2				
🔷 var2	INT	16#162E				
🔷 var3	INT	16#1B00				

1 • var1 16#04D2 := 1234;

-

2 💿 var2 16#162E := 5678; 3

var3 16#1B00 := var1 16#04D2 + var2 16#162E ;

#### Array variable monitor

It can't be display with list more than 1000 if array declaration exceeds more than 1000 at the default status.

recurppicational CC_FRG						
ession	Туре	Value	Prepared value	Address	Comment	
var1	ARRAY [019999]					
var1[0]	WORD	0				
var1[1]	WORD	0				
var1[2]	WORD	0				
var1[3]	WORD	0				
var1[4]	WORD	0				
var1[5]	WORD	0				
var1[6]	WORD	0				
🖗 var1[7]	WORD	0				
		<u> </u>				
var1[997]	WORD	0				
🖗 var1[998]	WORD	0				
var1[999]	WORD	0				

Change range of list display by double clicking "ARRAY[\*..\*\*\*]0.." to monitor array variable more than 1000 after.

List display is extended up to 20000 maximum.

Device.Application.PLC_PRG					
Expression	Туре	Value			
😑 🗼 var1	ARRAY [01999] (	0		kina	
<pre> var1[0] </pre>	WORD	0		5	
var1[1]	WORD	0			
		Monitoring Range Please enter the array indices to be monitored. Valid range:			d. [019999]
		Start inde	x: ::	IEIILS	2000 19999
					<u>Ok</u> <u>C</u> ancel
Ch					Nh.
PLC_PRG X	_		_		
pression	Туре	Value	Prepared value	Address	Comment
var1	ARRAY [019999]				
var1[0]	WORD	0			
var1[1]	WORD	0			
var1[2]	WORD	0			
var1[3]	WORD	0			
var1[4]	WORD	0			
var1[5]	WORD	0			

<pre>var1[19997]</pre>	WORD	0		
<pre>war1[19998]</pre>	WORD	0		
<pre>var1[19999]</pre>	WORD	0		
	Display up to 19	999	5 – 5	

0

0

WORD

WORD

var1[6]

🔷 var1[7]

#### 5.3 Flow control function

Flow control function is possible to confirm executing part of program by indicating green color on the part of execution. lative

entativ

Click "Flow control" of "Debug" after login.

Deb	ug <u>T</u> ools	<u>W</u> indow	Help
	<u>S</u> tart		F5
	Stop	Shif	t+F8
	Single <u>Cy</u>	de Ctr	l+F5
1	New Brea	kpoint	
ħ	Edit Break	cpoint	
	Toggle <u>B</u> r	eakpoint	F9
0	Disable Br	reakpoint	
0	Enable Br	e <u>a</u> kpoint	
ÇĒ	Step <u>O</u> ve	r	F10
G.	Step <u>I</u> nto		F8
¢,	Step Out	Shift	+F10
*重	<u>R</u> un to Cu	ırsor	
\$	Set ne <u>x</u> t :	Statement	
⇔	S <u>h</u> ow nex	t Statement	t
	Write valu	ues Ctr	I+F7
	Eorce val	ues	F7
	Unforce v	alues Al	t+F7
	Flow Cont	trol	
	Core Dum	μ	)
	Display M	ode	,

Display only executing part colored green.

jentai IF x 70 > 100 THEN 2 :=0; x ELSIF x 70 < 50 THEN</p> a 444 := 111; b 555 := 222; c 666 := 333; 5 ELSE a 444 := 444; b 555 := 555; c 666 := 666; Executing program part. 6 END IF

In the above example, there are three condition "x>100", "x<50" and "other" divided by condition of x value. Display executing part with green color in the case of "x=70" shows "other". g par. tative.

?ntative

## 5.4 Break point function

Break point function is possible to stop program at the position specified stopping position of application program for debugging.

The possible break point position is the position can be changed value of variable or the position to call program after branch.

"VA

100 THEN

< 100 THEN

<

:= 531 ;

100 THEN

?tiv

var10

var10

var1

var1

0

2 0

IF

#### Configuration method of Break point

Show example of Break point with structured text.

Grey colored circle appears where break point can be set after login.

1	•	IF var1 0 < 100 THEN
2	•	var10 0 := 531 ;
3		ELSE
4	•	var10 0 := 257 ;
5	•	END_IFRETURN
	_	

After click "New Break point" of "Debug" menu, property screen of Break point appears and then click "Location" tab. Specify POU to set Break point at "POU". Specify the line to set Break point at "Position". Check "Enable Break point immediately" to enable break point immediately after specifying.

*	Stort         F5         j           Stop         Shift+F8            Single Cyde         Ctrl+F5		
đ	New Breakpoint	New Breakpoint	
₩ 0	Edit Breakpoint Toggle Breakpoint F9 Disable Breakpoint Enable Breakpoint	Condition     Location       POU:     PLC_PRG [Device: PLC Logic: Application]	
	Step Qver     F10       Step Into     F8       Step Out     Shift+F10       Run to Cursor     Set next Statement	Position:  RETURN	
Û	Show next Statement Write values Ctrl+F7 Eorce values F7 Unforce values Alt+F7		
	Flow Control Core Dump Display Mode	Enable breakpoint immediately     OK     Cancel	

Display red colored circle at valid Break point.

Display grey colored circle at invalid Break point.

RIVE

Display yellow colored allow at the position program stooped.

#### 5.5 Single cycle Step function

#### 5.5.1 Single cycle execution function

Single cycle execution function is possible to execute only 1 cycle.

Execute only 1 cycle of program by clicking "Single cycle" of "Debug" menu. If there are several tasks, all tasks are executed only 1 cycle instead of task cycle.



#### 5.5.2 Step execution function

There are four kinds of step execution function in HX-CODESYS. Set some Break point is needed due to Step execution function execute program after stopping tempraly.

#### (1) Step-in function

Step-in function execute every one step of function or function block. Click "Step-in" of "Debug" menu to execute Step-in.



#### (3) Step-out function

If execute Step-out during the execution of function or function block by Step-in function, execute all program of function or function block and go through original program from function or function block.

Execute Step-in by clicking "Step-out" of "Debug" menu.

	_		
	Ç≣	Step <u>O</u> ver	F10
	φ	Step Into	F8
	€ <u>∃</u>	Ste <u>p</u> Out	Shift+F10
Τ	*亘	Run to Cursor	

Execute Step-out here



### (4) Execute until cursor line

Execute until cursor line execute program until position of cursor on the line.



## 5.6 Value force set and write value function

Value force set and write value function changes value of variable by other value. Value force function sets forced value when start and end of program. Write value function set value only once at the start of program.



# ▲ Caution

There is some risk like malfunction of device, danger of human depends on target system caused by use of Value force set and write value function. Please test enough and confirm stable operation of target system with value of variable to use for Value force set and write value function.

#### Configuration method of force function

Set writing value of variable by double clicking "Prepared value" of variable declaration part.



It is possible to set value for variable similar way.

Device.Applicatio	on.Force_writin	g	
Expression	Туре	Value	Prepared value
🔷 var1	INT	0	
🔷 var2	INT	0	100

Display value with "<>" at value monitor part of editor part by setting value.

var1 0 := var2 0 <100> \* 3 ;

#### Configuration methid of Write value function

Click "Write value" of "Debug" menu after setting write value of variable with similar way of Value force set function. The value is set only once when starting user program execution.

#### 5.7 Trace function

Trace function samples variable without dedicated program.

#### Configuration method

#### Create trace object

Add trace object by clicking "Add Object" "Trace" after right clicking "Application".



Trace editor appears by double clicking "Trace" object.



Configure "Task" by clicking "Configuration". Trace sampling cycle is defined by this task configuration. Configure other items if it is needed. It is recommended the trace task priority is configured lower due to avoid impacting the other process of user program when trace task load is heavy.

Trace Configuration		(	×
- Trace	Record Settings         Enable Trigger         Trigger Variable:         Trigger edge:         positive         Post Trigger (samples):         51         Trigger Level:	100ms	
	Task:     Trace_task       Record condition:		
	Create persistent Record	Re <u>s</u> olution: ms A <u>d</u> vanced	•
Add variable Delete variable	- 	OK Cancel	A

Configure trace variable at "Variable" by clicking "Add variable". Configure other items if it is needed. In case of adding new variable, configure by clicking "Add variable" with similar way.

Trace Configuration		
□ Trace	Variable Settings	
	Variable: •	
	Graph <u>c</u> olor:	
	Line type:	
	Point type: Dot •	
	Activate minimum warning	
	Critical lower limit: 0	
	Warning minimum color:	
	Activate maximum warning	
	Critical upper limit:	
	Warning maximum color:	
	Display Settings	
Add variable		
Delete variable	<u>QK</u> <u>Cancel</u>	
	5 – 7	

Download trace data to HX-CPU by clicking "Download Trace" of "Trace" menu after login.

Trace Build Online Debug Add Variable Download Trace

Tools

Display starts immediately according to the configured contents.



Following operation is possible after displaying trace data on "Trace" menu. Please refer on-line help for further detail 3ntai information.

il ve

- -Start/Stop of Trace data
- -Customize display graph
- -Access Trace data of HX-CPU
- -Save/Read of Trace data

entative

jentativo

# Appendix Known Restrictions

Following restrictions has been recognized with HX-CODESYS V3.5 SP8 Patch4. These are depend on the based software CODESYS V3.5 SP8 Patch4 from 3S-Smart Software Solutions, and will be improved later version.

#### [Open project]

When open project file by specifying file from saved project file, sometimes POU can't be opened.



This can be avoided and Project can be opened by "File"-"Open Project" after invoking HX-CODESYS.

🍅 Pro	ogram.project*	- HX-COE	DESYS
Eile	<u>E</u> dit <u>V</u> iew <u>P</u> ro	oject <u>B</u> uild	<u>O</u> nline
1	New Project	Ctrl+N	h @ >
2	Open Project	Ctrl+O	
	<u>Close</u> Project		

entative

#### [Open project file]

Getting day information command DTU.GetDayOfWeek() can't get correct information on February 29<sup>th</sup> (leap year) and day information is "7".

## [Application information]

It is possible to confirm PLC project and PLC project application information at login, however latest updated day and time of PLC application is forwarded 9 hours if previous download is done by "Download with login". This is no problem on execution.

\*Latest updating day is displayed correctly, when previous download done by "On-line change with login".

HX-CODES	SYS		<u>×</u>	<li>S</li>	
A	Application changed since last download. What	do you want to do?			
L_c	Options				
0	Cogin with online change.				
<u>ہ</u>	Login with download.				
0	Login without any change.				
<b>v</b>	Update bootproject				
	ок	Cancel	Details		
Application Informatio	20		+		
 аррисатон дног шато	¬				
Application Information	Application Content				
	Application in the IDE:	Applicatio	on in the PLC:	au 0 hours formuardad	
Project name:	Untitled26	Untitled26	Dispi	ay 9 hours for warded	
Last modification: IDF version:	2016年7月14日 22:41 HX-CODESYS V3.5 SP8 Patch 4	2015年7月 HX-CODES	YS V3.5 SP8 Patch 4		
Author:					
Version:					
Description:		<u> </u>		<u> </u>	
	A1 –	2			

### [Modbus-RTU Master]

## [Modbus channel offset]

Don't set "0xFFFF" for ofset value of Slave Modbus channel, when using Modbus-RTU master.

ITIV.

ModbusChannel		X			
Channel					
Name	Channel 0				
Access Type	Read Coils (Function Code 1)	<b>•</b>			
Trigger	Cyclic Vc	le Time (ms) 100			
Comment					
	1				
-READ Register-					
Offset	0xFFFF	<u> </u>			
Length	1				
Error Handling	Keep last Value				
Offset					
Langth					
Length	]1		Don't set 0xFF	FF.	
		OK Cancel			
		A1 – 3			

### [Modbus-RTU Slave]

#### [Disenable of Device]

Query will be sent even if Modbus-RTU slave device is disenabled. Therefore, slave function block error(\*) is

detected due to receive timeout slave is occurred.

\*In case of Modbus-RTU: ModbusSlaveComPort\_Diag

In case of Modbus-TCP: ModbusTCPSlave\_Diag

#### In case of Modbus-RTU

### Modbus\_Master\_COM\_Port (Modbus Master, COM Port)

🎁 Modbus\_Slave\_COM\_Port (Modbus Slave, COM Port)

Modbus\_Slave\_COM\_Port\_1 (Modbus Slave, COM Port) Modbus Slave\_COM\_Port\_2 (Modbus Slave, COM Port)

Query is sent even if disenable configured

aive

#### In case of Modbus-TCP



 Modbus\_TCP\_Slave\_1 (Modbus TCP Slave)
 Query is sent even if disenable configured

 Modbus\_TCP\_Slave\_2 (Modbus TCP Slave)
 Query is sent even if disenable configured

#### [Modbus-TCP Master]

#### [Chanel configuration]

OK button becomes non-activated if specific offset address is used for slave channel registration at Modbus-TCP master.

Specific offset address: 0x0001 / 0x0005 / 0x03E8

This can be avoided by pressing Enter instead of OK clicking.

ModbusChannel	ModbusChannel		×
Channel	Channel		_
Name Channel 2	Name	Channel 2	
Access Type Read Coils (Function Code 1)	Access Type	Write Single Coil (Function Code 5)	
Trigger Cyclic  Cycle Time (ms)	100 Trigger	Cyclic   Cycle Time (ms) 100	
Comment	Comment		
READ Register	READ Register		
Langth 1			
	Creative dise		
	Error Handling	Keep last Value	
WRITE Register		er	
Offset	Offset	Default	
Length 1	Length	1	
	<u>C</u> ancei	<u>OK</u> <u>Cancel</u>	
		December 1 and 1	
		Become non-activated status	
	Δ1 _ 4		

#### [Modbus-TCP Slave]

### [Device function code 15 (Write multiple coils)]

Configure number of coil is 8 integral multiples when write data using Function code 15 (Write multiple coils) from external Modbus-TCP master and HX-CPU is used as Modbus-TCP slave. Operation is not properly if configure is not 8 integral multiples.

### [Start address of Coil]

Configure start address of coil is 16 integral multiples when it is not specified 0(zero) and HX-CPU is used as Modbus-TCP slave. Operation of Function code 5 (write single coil) is not properly if other value is set.

General	Configured Parameters				
Modbus TCP Slave Device I/O	TimeOut:	2000 🛨	(ms)		
Mapping	Slave Port:	502 🛨			
Information	Unit ID:				
	Holding Registers (%IW):	10			
	Input Registers (%QW):	10			
	-Data Model				
	Statt Addresses				
	Coils:			Set 16 integral multin	las valua
	Discrete Inputs:			Set 10 megrai mutup	ico value
	HoldingRegister:				
	Input Register:				
	Holding- and Input-Reg	ister Data Areas or	verlav		
			8		
			8		