

PROFINET

USER'S MANUAL

FUSION SCR POWER CONTROLLERS



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WARNING: The Control Concepts, Inc. power controllers use power thyristors to switch voltage to the connected load. Line voltage must be assumed at the output terminals at all times, even when the control signal has been removed and the load voltage appears to be off. It has been mandated by the National Electrical Code and the Occupational Safety and Health Act of 1970 that a physical disconnect be opened ahead of all remotely actuated controls before performing any maintenance work on the controller or its connected load.

PROPRIETARY DATA

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CONTROL CONCEPTS, INC
8077 CENTURY BLVD
CHANHASSEN, MN 55317
PHONE: (952) 474-6200
TOLL FREE: (800) 765-2799
FAX: (952) 474-6070
www.ccipower.com

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1. OVERVIEW

In general, FUSION parameters are all 16 bit integer values. However, there are some parameters such as Load Power Zone 1 which use two registers for the value (32 bit value.) These long word situations are clearly documented with HI and LO word parameters.

Some values may have digits to the right of the decimal point. The decimal point, or resolution, will not be part of the message. A parameter with one decimal place will be scaled x10, two decimal places scaled x100.

Example: 5.00 must be scaled and sent as 500. When reading, it will also need to be scaled using a x100 “scale factor.”

The first two bytes of PLC memory are status bytes and are not used.

The Digital Setpoints and Digital System Command are the only parameters that can be set via the PLC at this time.

The maximum supported sampling rate is 5 Hz.

2. FUSION PROFINET TCP WIRING (-N Digital Communication Option)

Ethernet 10BaseT (Twisted Pair)		
Pin #	Signal Name	Function
1	TD+	Transmit Data
2	TD-	Transmit Data
3	RD+	Receive Data
4	NC	No Connection
5	NC	No Connection
6	RD-	Receive Data
7	NC	No Connection
8	NC	No Connection



FUSION with PROFINET uses a standard Ethernet pin-out shown above. We recommend using at least Cat 5e shielded cable between the controller and other Ethernet-enabled devices.

3. FUSION CONNECTION SETTINGS

Use the Control Panel software and USB connection to setup the Profinet settings for the power controller. After connecting the power controller to Control Panel, select the device and open the “Communication” category as shown in Figure 4.00.

3.1 TCP/IP

The “IP Address” field [SP 126] displays the IP Address stored in the power controller. Enter the desired IP Address into this field, and press the “Enter” key to write the IP Address to the device. The “IP Address (Comm. Module)” field [MP 1915] displays the IP Address as read from the Fieldbus communications card. The “IP Address (Comm. Module)” value should match the “IP Address (Comm. Module)” value. If these values do not match, try changing the “IP Address” value and see if the “IP Address (Comm. Module)” values updates, or contact CCI technical support.

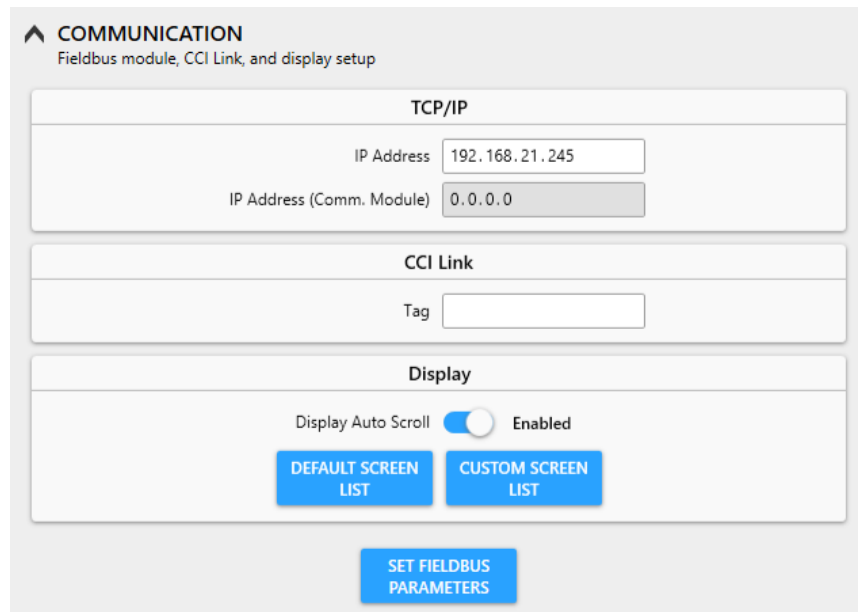
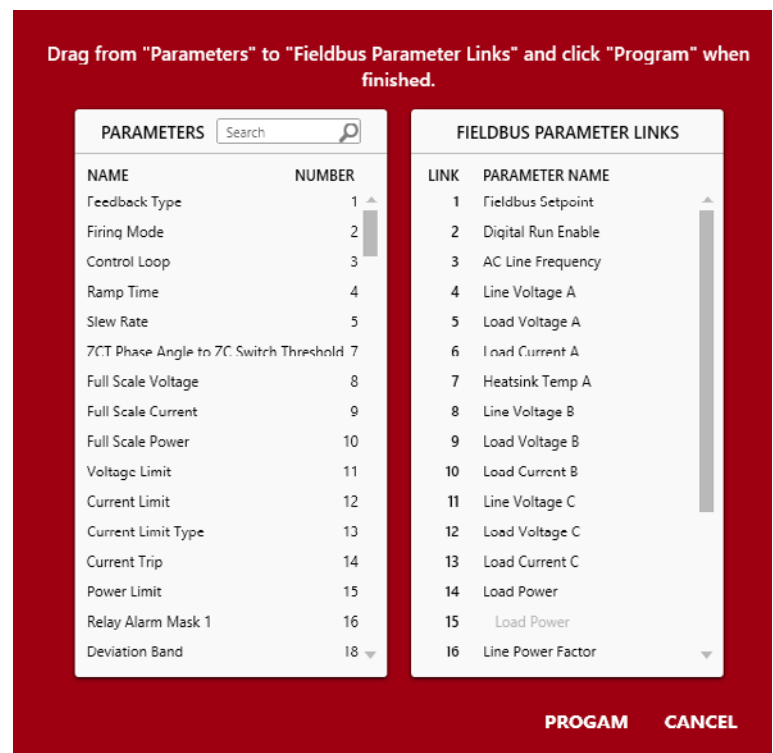


Figure 4.00: Use Control Panel to adjust the PROFINET settings for the power controller

3.2 Set Fieldbus Parameters

By default, the FUSION Fieldbus interface exposes parameters that are most commonly used. You can customize the FUSION parameters exposed by the Fieldbus interface. Click the “SET FIELDBUS PARAMETERS” button to open the dialog shown in Figure 4.01. Drag available parameters from the list on the left to the desired location in the “Fieldbus Parameter Links” on the right. A parameter assigned to a link can also be moved from one location to another by dragging.

When complete, click the “PROGRAM” button to save the changes to the FUSION. All links must have an assigned parameter in order to “PROGRAM” the controller.



NAME	NUMBER
Feedback Type	1
Firing Mode	2
Control Loop	3
Ramp Time	4
Slew Rate	5
7CT Phase Angle to 7C Switch Threshold	7
Full Scale Voltage	8
Full Scale Current	9
Full Scale Power	10
Voltage Limit	11
Current Limit	12
Current Limit Type	13
Current Trip	14
Power Limit	15
Relay Alarm Mask 1	16
Deviation Band	18

LINK	PARAMETER NAME
1	Fieldbus Setpoint
2	Digital Run Enable
3	AC Line Frequency
4	Line Voltage A
5	Load Voltage A
6	Load Current A
7	Heatsink Temp A
8	Line Voltage B
9	Load Voltage B
10	Load Current B
11	Line Voltage C
12	Load Voltage C
13	Load Current C
14	Load Power
15	Load Power
16	Line Power Factor

Figure 4.01: Configure the Ethernet IP parameter links using Control Panel

3.3 Temporary vs. Permanent IP Address Behavior

With Profinet, the “Station Name,” sometimes referred to as “Device name,” is more important than the IP address in the device identification on the network. Therefore, the Station Name of each device on the network must be unique.

The DCP Set IP Address command contains an option to set the IP address as “Permanent” or “Temporary”.

Definition

- “Permanent” means that the Profinet module on the controller will save the IP address to non-volatile memory and begin using the IP address immediately.
- “Temporary” means that the Profinet module on the controller will not save the IP address setting, but will begin using the IP address immediately. When the IP address has been set “Temporary”, PROFINET-IO requires the device to use an IP address of 0.0.0.0 after the next power-cycle or device reset.

Explanation

From observations, all PNIO PLCs set the IP address as “Temporary”. The PLC will use the device’s station name and MAC address to identify the device on the network and set the IP address of the device correctly, but as “Temporary”.

This may cause the following scenario to occur (in this scenario it is assumed that the IP address is initially set as permanent):

1. Utilizing Control Panel software, the user sets the IP address of the controller, or using PNIO configuration software, the user searches for the controller device with the unique station name on the network and sets its IP address.
2. After power is cycled to the controller, it retains the IP address as expected.
3. Once the PLC is configured, it connects to the controller, and communicates as expected.
4. The PLC is powered-down, or disconnected, and power is cycled to the controller.
5. The user attempts to “ping” the controller on the network at the IP address assigned and it does not respond.
6. The user connects with the Control Panel software and performs a “Get” of the IP address and finds that the IP address is now 0.0.0.0
7. The user attempts to set the IP address of the controller, again, using the Control Panel software. Yet each time a “Get” is performed, the controller reports an IP address of 0.0.0.0. The user may wonder why they can’t set the IP address, as they have before, using the Control Panel software!

In this situation, the user will find that when they power-up and connect the PLC everything works as expected, and as long as they don’t cycle power to the controller they can ping it successfully at the expected IP address.

PARAMETER LIST

Input/Output Range: Offset 0 - 18

*Offset 0 Write Enable

Units: N/A

Minimum: 0

Maximum: 1

Representation:

0 = Offset 2-18 set to Read Only

1 = Offset 2-18 Write Enable

*Always write a 1 to offset 0 to enable read/write for offset 2-18. Otherwise the values written in offset 2-18 will not be written to the controller.

Offset 2 Digital Setpoint 1

Units: % of Full Scale

Minimum: 0.00

Maximum: 100.00

Default: 0.00

Offset 4 Digital Setpoint 2

Units: % of Full Scale

Minimum: 0.00

Maximum: 100.00

Default: 0.00

Offset 6 Digital Setpoint 3

Units: % of Full Scale

Minimum: 0.00

Maximum: 100.00

Default: 0.00

Offset 8 Digital Setpoint 4

Units: % of Full Scale

Minimum: 0.00

Maximum: 100.00

Default: 0.00

Offset 10 Digital Setpoint 5

Units: % of Full Scale

Minimum: 0.00

Maximum: 100.00

Default: 0.00

Offset 12 Digital Setpoint 6

Units: % of Full Scale

Minimum: 0.00

Maximum: 100.00

Default: 0.00

Offset 14 Digital Setpoint 7

Units: % of Full Scale

Minimum: 0.00

Maximum: 100.00

Default: 0.00

Offset 16 Digital Setpoint 8

Units: % of Full Scale

Minimum: 0.00

Maximum: 100.00

Default: 0.00

Offset 18 Digital System Command

Units: N/A

Minimum: 00000000 = 0

Maximum: 11111111 = 255

Representation:

Bit			
MSB	7	=	not used
	6	=	not used
	5	=	not used
	4	=	not used
	3	=	Zone 4, Run=1/Stop=0
	2	=	Zone 3, Run=1/Stop=0
	1	=	Zone 2, Run=1/Stop=0
LSB	0	=	Zone 1, Run=1/Stop=0

Parameters – Input Range: Offset 20 - 160

Offset 20 Line Frequency

Units: Hz
Minimum: 0.0
Maximum: 99.9

Offset 22 Line Voltage A

Units: RMS Volts
Minimum: 0.0
Maximum: 999.9

Offset 24 Load Voltage A

Units: Volts RMS or Average
Minimum: 0.0
Maximum: 999.9

Offset 26 Load Current A

Units: Amps RMS or Average
Minimum: 0.0
Maximum: 9999.9

Offset 28 Load Resistance A (Not Active)

Units: Ohm
Minimum: 0.0
Maximum: 9999.9

Offset 30 Heatsink temp A (Not Active for Compact FUSION)

Units: Degrees C
Minimum: 0.0
Maximum: 999.9

Offset 32 Line Voltage B

Units: RMS Volts
Minimum: 0.0
Maximum: 999.9

Offset 34 Load Voltage B

Units: Volts RMS or Average
Minimum: 0.0
Maximum: 999.9

Offset 36

Units:
Minimum:
Maximum: 9999.9

Load Current B

Amps RMS or Average
0.0
9999.9

Offset 38

Units:
Minimum:
Maximum: 9999.9

Load Resistance B (Not Active)

Ohm
0.0
9999.9

Offset 40

Units:
Minimum:
Maximum: 999.9

Heatsink temp B

Degrees C
0.0
999.9

Offset 42

Units:
Minimum:
Maximum: 999.9

Line Voltage C

RMS Volts
0.0
999.9

Offset 44

Units:
Minimum:
Maximum: 999.9

Load Voltage C

Volts RMS or Average
0.0
999.9

Offset 46

Units:
Minimum:
Maximum: 9999.9

Load Current C

Amps RMS or Average
0.0
9999.9

Offset 48

Units:
Minimum:
Maximum: 9999.9

Load Resistance C (Not Active)

Ohm
0.0
9999.9

Offset 50

Units:
Minimum:
Maximum: 999.9

Heatsink temp C (Not Active for Compact FUSION)

Degrees C
0.0
999.9

Offset 52

Units:
Minimum:
Maximum: 999.9

Line Voltage D

RMS Volts
0.0
999.9

Offset 54 Load Voltage D
Units: Volts RMS or Average
Minimum: 0.0
Maximum: 999.9

Offset 56 Load Current D
Units: Amps RMS or Average
Minimum: 0.0
Maximum: 9999.9

Offset 58 Load Resistance D (Not Active)
Units: Ohm
Minimum: 0.0
Maximum: 9999.9

Offset 60 Heatsink temp D
Units: Degrees C
Minimum: 0.0
Maximum: 999.9

Offset 62 Load Power Zone 1 HI (MSW)
Units: Watts or VA
Minimum: -99
Maximum: 99

Offset 64 Load Power Zone 1 LO (LSW)
Units: Watts or VA
Minimum: 0
Maximum: 65535

Offset 66 Power Factor Zone 1
Units: N/A
Minimum: 0.00
Maximum: 9.99

Offset 68 Controller State Zone 1
Units: N/A
Minimum: 0
Maximum: 2
Representation:

0	=	STOP
1	=	RUN
2	=	FAULT

Offset 70 Output% Zone 1
Units: % ON
Minimum: 0.0
Maximum: 999.9

Offset 72 Setpoint Reference Zone 1 HI (MSW)
Units: V, A, W
Minimum: -99
Maximum: 99

Offset 74 Setpoint Reference Zone 1 LO (LSW)
Units: V, A, W
Minimum: 0
Maximum: 65535

Offset 76 Feedback Zone 1 HI (MSW)
Units: V, A, W
Minimum: -99
Maximum: 99

Offset 78 Feedback Zone 1 LO (LSW)
Units: V, A, W
Minimum: 0
Maximum: 65535

Offset 80 Control Loop Error Zone 1 HI (MSW)
Units: V, A, W
Minimum: -99
Maximum: 99

Offset 82 Control Loop Error Zone 1 LO (LSW)
Units: V, A, W
Minimum: 0
Maximum: 65535

Offset 84 Warning Alarm Zone 1
Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255
Representation:

Bit	
MSB 7	= not used
6	= not used
5	= Load Imbalance (Not Active)
4	= Shorted SCR
3	= Heatsink Temp
2	= Power Limit
1	= Current Limit
LSB 0	= Voltage Limit

Offset 86 Load Power Zone 2 HI (MSW)

Units: Watts or VA
Minimum: -99
Maximum: 99

Offset 88 Load Power Zone 2 LO (LSW)

Units: Watts or VA
Minimum: 0
Maximum: 65535

Offset 90 Power Factor Zone 2

Units: N/A
Minimum: 0.00
Maximum: 9.99

Offset 92 Controller State Zone 2

Units: N/A
Minimum: 0
Maximum: 2
Representation:
0 = STOP
1 = RUN
2 = FAULT

Offset 94 Output% Zone 2

Units: % ON
Minimum: 0.0
Maximum: 999.9

Offset 96 Setpoint Reference Zone 2 HI (MSW)

Units: V, A, W
Minimum: -99
Maximum: 99

Offset 98 Setpoint Reference Zone 2 LO (LSW)

Units: V, A, W
Minimum: 0
Maximum: 65535

Offset 100 Feedback Zone 2 HI (MSW)

Units: V, A, W
Minimum: -99
Maximum: 99

Offset 102 Feedback Zone 2 LO (LSW)

Units: V, A, W
Minimum: 0
Maximum: 65535

Offset 104 Control Loop Error Zone 2 HI (MSW)

Units: V, A, W
Minimum: -99
Maximum: 99

Offset 106 Control Loop Error Zone 2 LO (LSW)

Units: V, A, W
Minimum: 0
Maximum: 65535

Offset 108 Warning Alarm Zone 2

Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255
Representation:

Bit		
MSB	7	= not used
	6	= not used
	5	= Load Imbalance (Not Active)
	4	= Shorted SCR
	3	= Heatsink Temp
	2	= Power Limit
	1	= Current Limit
LSB	0	= Voltage Limit

Offset 110 Load Power Zone 3 HI (MSW)

Units: Watts or VA
Minimum: -99
Maximum: 99

Offset 112 Load Power Zone 3 LO (LSW)

Units: Watts or VA
Minimum: 0
Maximum: 65535

Offset 114 Power Factor Zone 3

Units: N/A
Minimum: 0.00
Maximum: 9.99

Offset 116 Controller State Zone 3

Units: N/A

Minimum: 0

Maximum: 2

Representation:

0 = STOP

1 = RUN

2 = FAULT

Offset 118 Output% Zone 3

Units: % ON

Minimum: 0.0

Maximum: 999.9

Offset 120 Setpoint Reference Zone 3 HI (MSW)

Units: V, A, W

Minimum: -99

Maximum: 99

Offset 122 Setpoint Reference Zone 3 LO (LSW)

Units: V, A, W

Minimum: 0

Maximum: 65535

Offset 124 Feedback Zone 3 HI (MSW)

Units: V, A, W

Minimum: -99

Maximum: 99

Offset 126 Feedback Zone 3 LO (LSW)

Units: V, A, W

Minimum: 0

Maximum: 65535

Offset 128 Control Loop Error Zone 3 HI (MSW)

Units: V, A, W

Minimum: -99

Maximum: 99

Offset 130 Control Loop Error Zone 3 LO (LSW)

Units: V, A, W

Minimum: 0

Maximum: 65535

Offset 132 Warning Alarm Zone 3

Units: N/A

Minimum: 00000000 = 0

Maximum: 11111111 = 255

Representation:

Bit

MSB 7 = not used

6 = not used

5 = Load Imbalance

4 = Shorted SCR

3 = Heatsink Temp

2 = Power Limit

1 = Current Limit

LSB 0 = Voltage Limit

Offset 134 Load Power Zone 4 HI (MSW)

Units: Watts or VA

Minimum: -99

Maximum: 99

Offset 136 Load Power Zone 4 LO (LSW)

Units: Watts or VA

Minimum: 0

Maximum: 65535

Offset 138 Power Factor Zone 4

Units: N/A

Minimum: 0.00

Maximum: 9.99

Offset 140 Controller State Zone 4

Units: N/A

Minimum: 0

Maximum: 2

Representation:

0 = STOP

1 = RUN

2 = FAULT

Offset 142 Output% Zone 4

Units: % ON

Minimum: 0.0

Maximum: 999.9

Offset 144 Setpoint Reference Zone 4 HI (MSW)

Units: V, A, W

Minimum: -99

Maximum: 99

Offset 146 Setpoint Reference Zone 4 LO (LSW)

Units: V, A, W
Minimum: 0
Maximum: 65535

Offset 148 Feedback Zone 4 HI (MSW)

Units: V, A, W
Minimum: -99
Maximum: 99

Offset 150 Feedback Zone 4 LO (LSW)

Units: V, A, W
Minimum: 0
Maximum: 65535

Offset 152 Control Loop Error Zone 4 HI (MSW)

Units: V, A, W
Minimum: -99
Maximum: 99

Offset 154 Control Loop Error Zone 4 LO (LSW)

Units: V, A, W
Minimum: 0
Maximum: 65535

Offset 156 Warning Alarm Zone 4

Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255

Representation:

Bit			
MSB	7	=	not used
	6	=	not used
	5	=	Load Imbalance (Not Active)
	4	=	Shorted SCR
	3	=	Heatsink Temp
	2	=	Power Limit
	1	=	Current Limit
LSB	0	=	Voltage Limit

Offset 158 Model - Config Data

Units: CODED
Minimum: 0000
Maximum: FFFF
Default: 0000

Offset 160 Inhibit Alarm Status

Units: N/A
Minimum: 00000000 = 0
Maximum: 11111111 = 255

Representation:

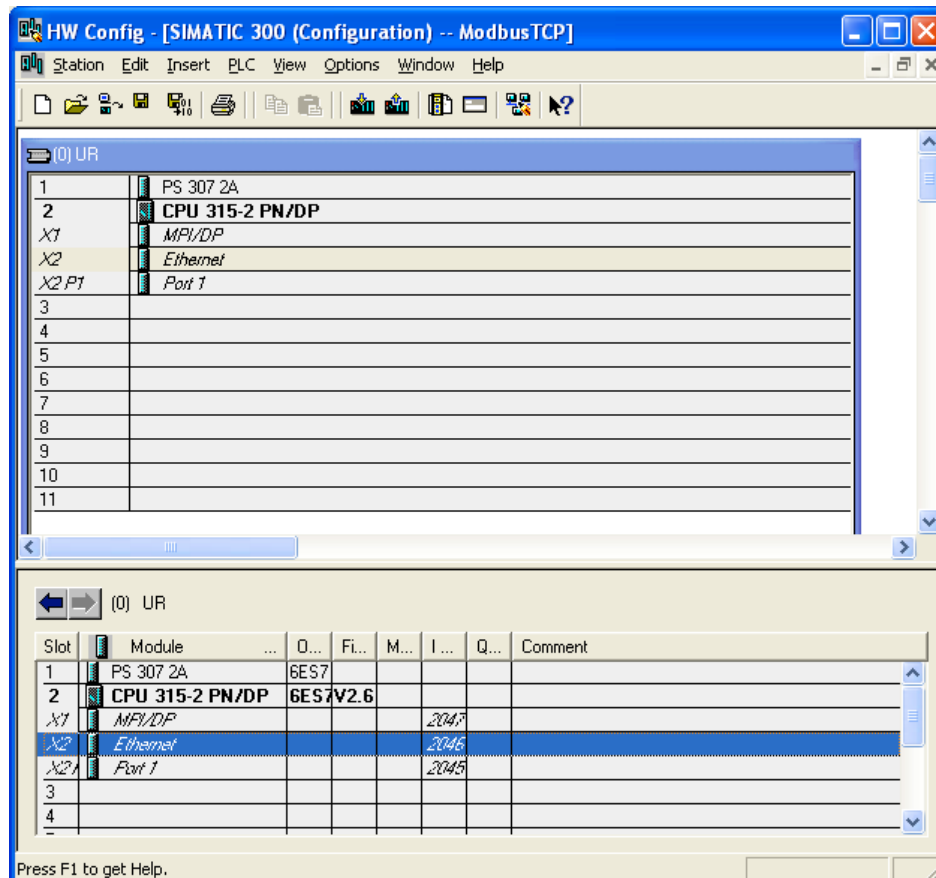
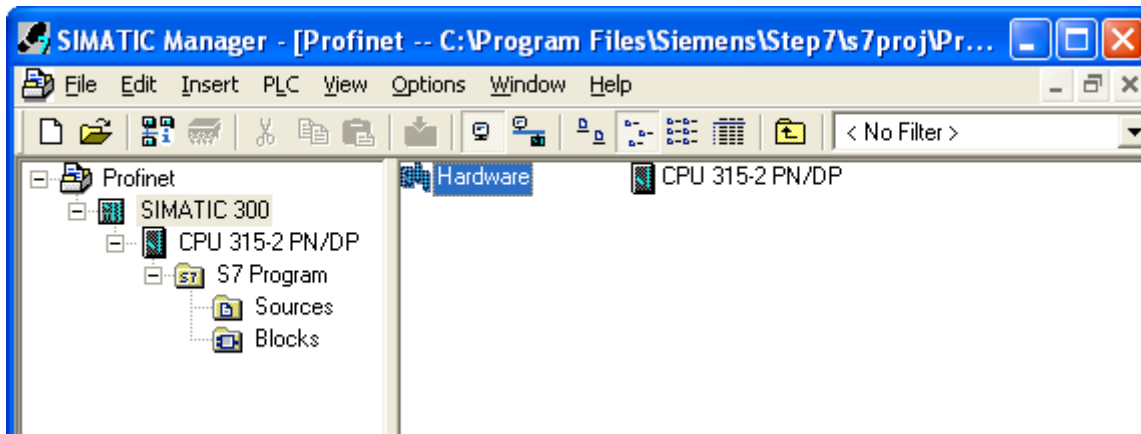
Bit			
MSB	7	=	Watchdog Timeout
	6	=	Memory Error
	5	=	not used
	4	=	not used
	3	=	Line Phase Loss
	2	=	PLL Lock Loss
	1	=	Heatsink Over-Temp
LSB	0	=	Current Trip

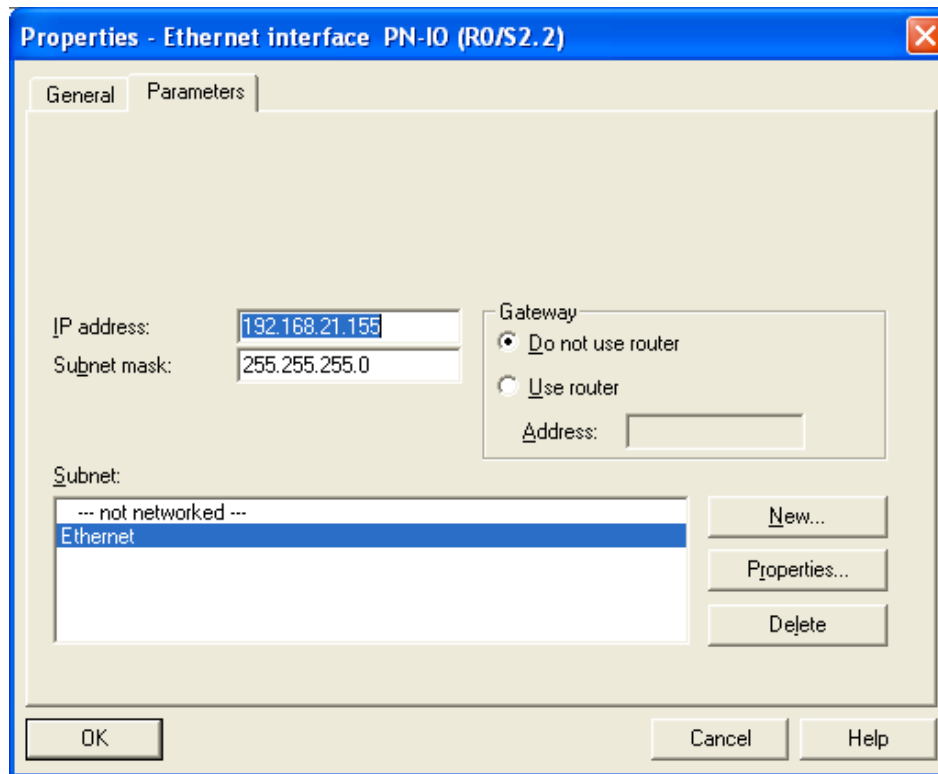
4. FUSION PROFINET WITH SIEMENS CPU-315-2 PN/DP PLC

PLC: Siemens CPU-315 PN/DP PLC (6ES7 315-2EH13-0AB0)

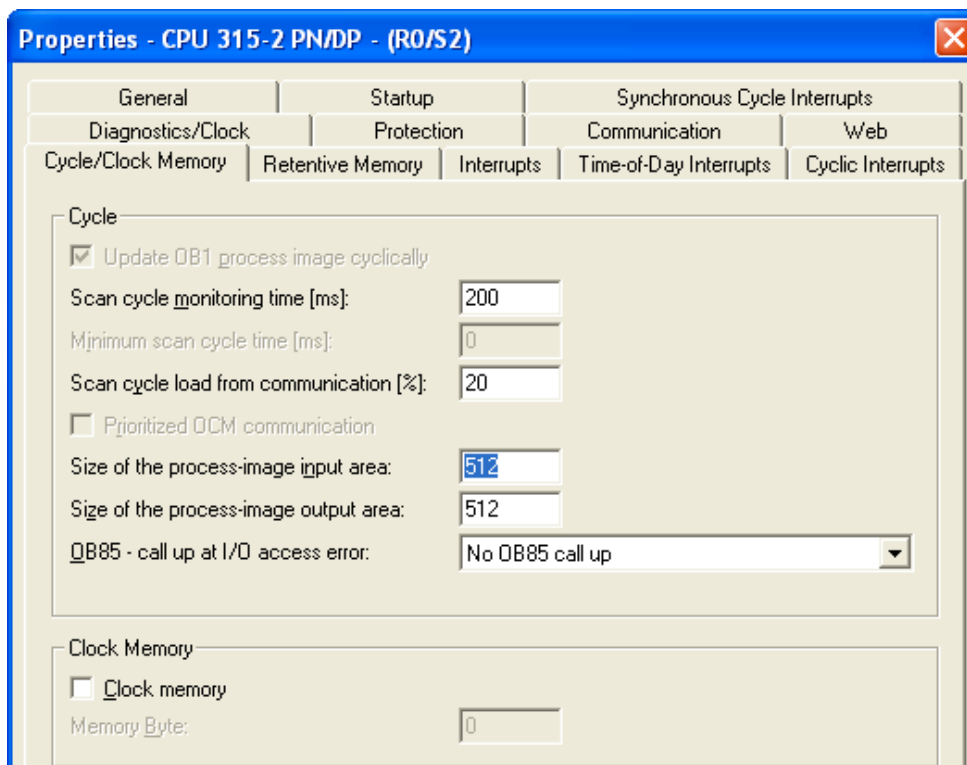
PLC software: Simatic Manager - Step 7

- 1) Install Simatic Manager per instruction manual.
- 2) Create S7 project, power on PLC, and set IP address of PLC in HW Config.

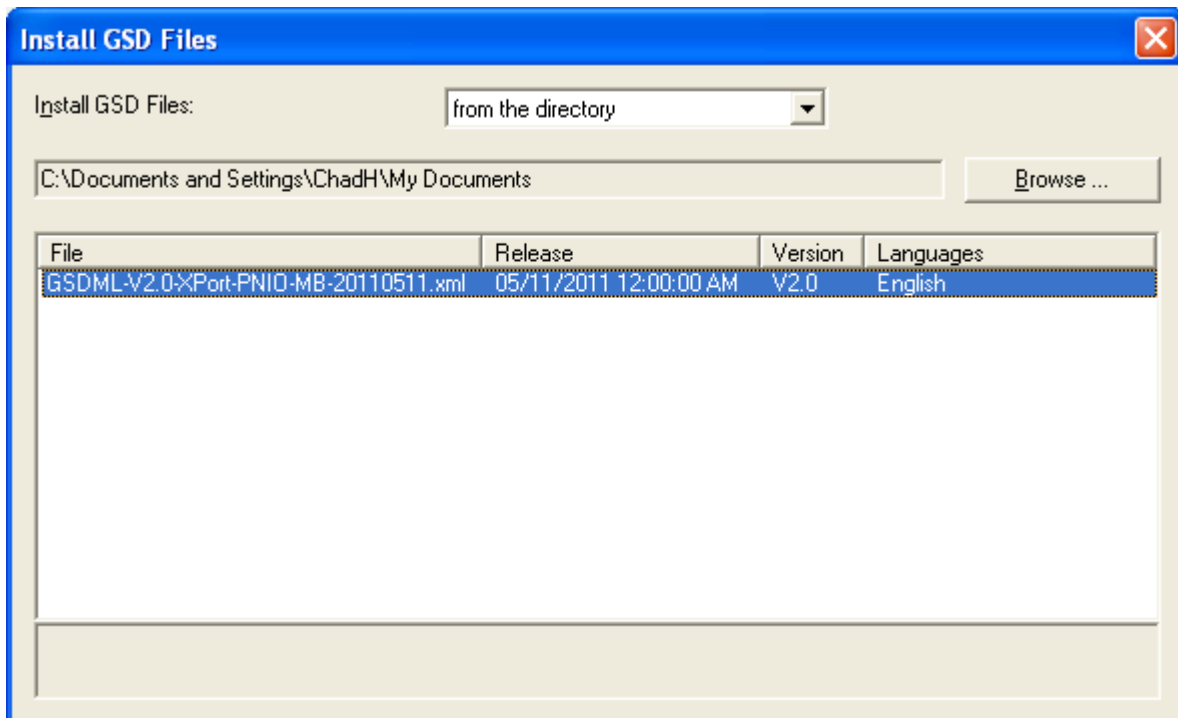




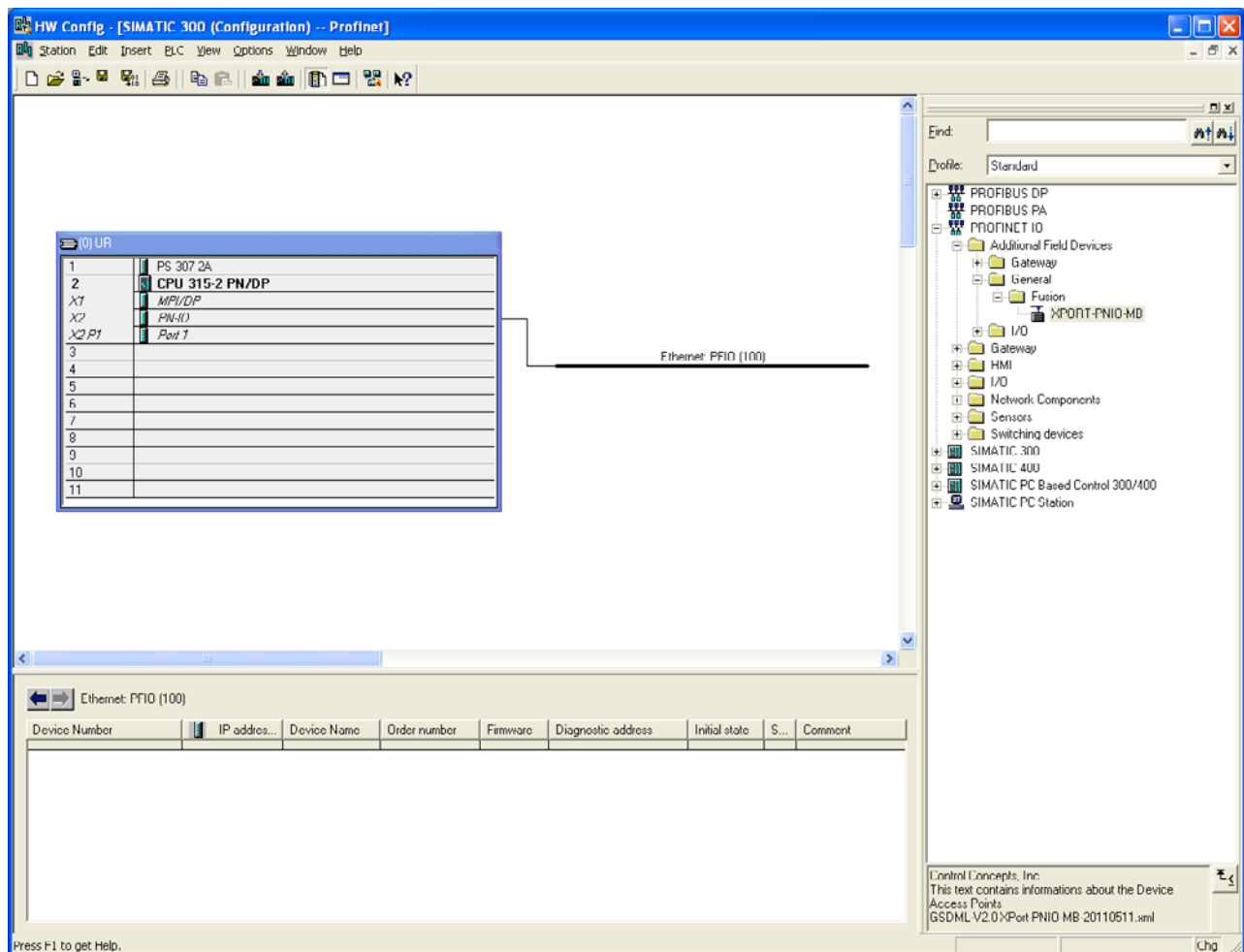
3) Double click CPU315 PLC and click “Cycle/Clock Memory” tab. Increase size of process-image input and output area to 512 bytes. Increase the monitoring time to 200 ms. The FUSION parameters will be updated every PLC cycle when located inside of the process image.

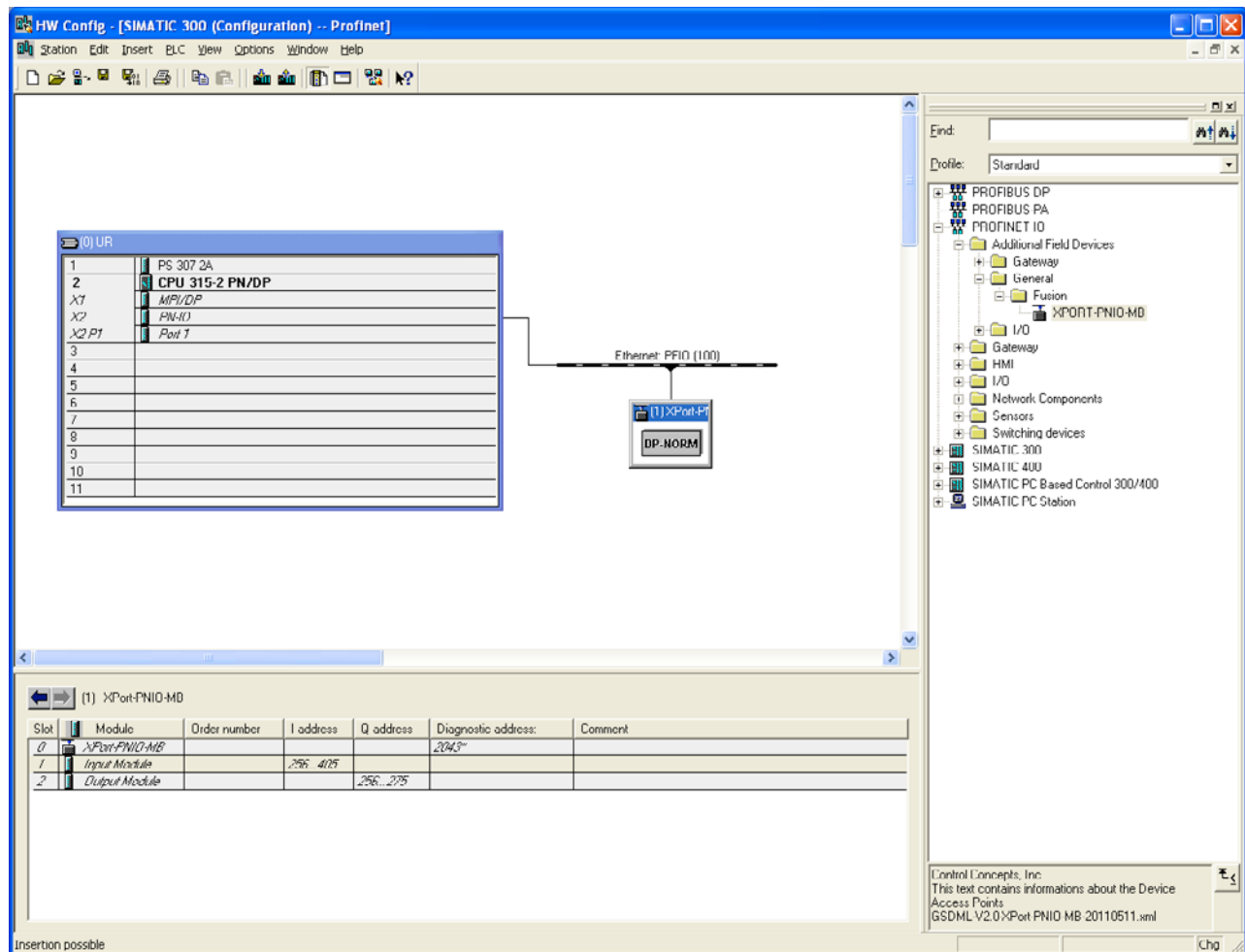


4) Under “Options” click “Install GSD File” and install FUSION GSD file.



5) The FUSION device is under “Profinet IO” - “Additional Field Devices” - “General” - “Fusion” - “XPORT-PNIO-MB.” Drag the XPORT device into Profinet Bus.





6) Double-click “XPORT-PNIO-MB.” Update FUSION IP address to the address set in the FUSION Control Panel and then click the “IO Cycle” tab.

Properties - XPort-PNIO-MB

General | IO Cycle

Short description: XPort-PNIO-MB

This text contains informations about the Device Access Points

Order No./ firmware:

Family: Fusion

Device name: XPort-PNIO-MB

GSD file: GSDML-V2.0-XPort-PNIO-MB-20110511.xml

Change Release Number...

Node in PROFINET IO System

Device number: 1 PFIO (100)

IP address: 192.168.21.234 Ethernet...

☒ Assign IP address via IO controller

Comment:

OK Cancel Help

COMMUNICATION

Fieldbus module, CCI Link, and display setup

TCP/IP

IP Address 192.168.21.245

IP Address (Comm. Module) 0.0.0.0

Change “Update time [ms] to 16 by modifying the Factor.

Properties - XPort-PNIO-MB [X]

General | **IO Cycle**

Update Time

Mode: [---]

Update time [ms]: [16.000] = Factor [16] x Send clock [ms] [1.000]

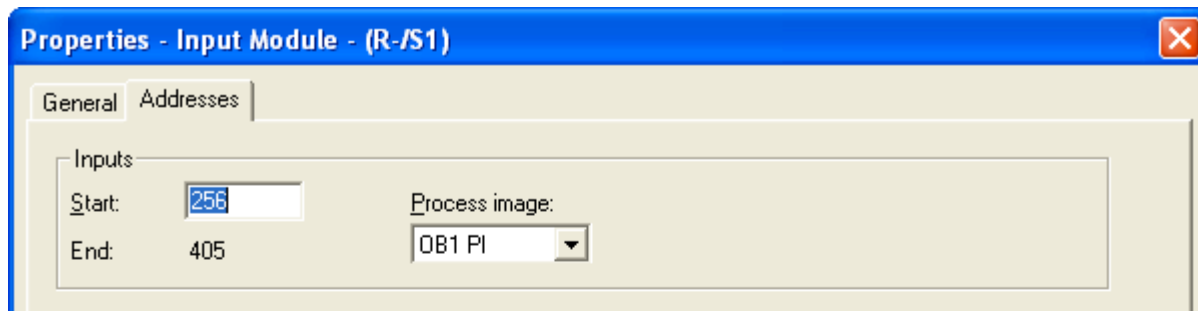
Watchdog Time

Number of accepted update cycles with missing IO data: [3]

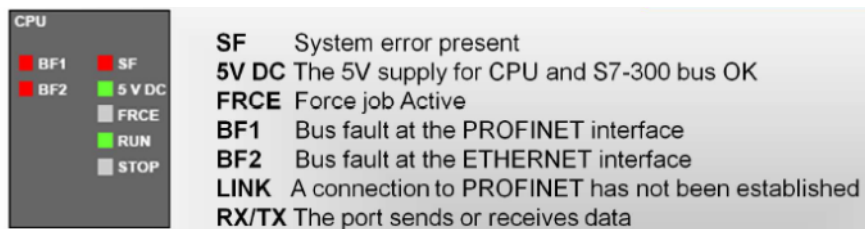
Watchdog time [ms]: [48.000]

OK Cancel Help

7) Note the start addresses for Input and Output modules. For the picture below, PLC memory location I-258 would correspond to “Digital Setpoint 1.”



8) Download configuration to PLC and check that no bus faults are present.



Copy OB100 source code into project

//Enable modbus scanner

```
L  W#16#FFFF
T  QW  256
```

//Initialize variables

```
L  0
T  "TEST".SUCCESS
T  "TEST".FAIL
T  "TEST".WRITE
T  "TEST".READ
T  "TEST".STATE
```

// Set to Digital Setpoint 1 20.00%

```
L  2000
T  QW  258
T  "TEST".WRITE
```

// Set Digital System Command, zone 1 to run

```
L  1
T  QW  274
```

```
L  0
T  QW  260
T  QW  262
T  QW  264
T  QW  266
T  QW  268
T  QW  270
T  QW  272
```

Copy OB1 source code into project

```
L  "TEST".STATE
INC 1
T  "TEST".STATE
L  2
==D
JCN ST
L  0
T  "TEST".STATE
```

//160 ms wait, with overhead, roughly 5 Hz sampling

```
CALL "WAIT"
WT:=20000
CALL "WAIT"
WT:=20000
CALL "WAIT"
WT:=20000
CALL "WAIT"
WT:=20000
CALL "WAIT"
WT:=20000
CALL "WAIT"
WT:=20000
CALL "WAIT"
WT:=20000
CALL "WAIT"
WT:=20000
```

BEU

// Read Load Power

```
ST: L  IW 320
T  "TEST".READ
```

// Check if Load Power is greater than zero

```
L  0
>D
JC  SCS
```

// Set Fail if Load Power is zero

```
L  "TEST".FAIL
L  1
+D
T  "TEST".FAIL
```

// Set Digital System Command, zone 1 to run

```
L  1
T  QW 274
```

JU END

SCS: L "TEST".SUCCESS

```
L  1
+D
T  "TEST".SUCCESS
```

// Increase Digital Setpoint until Load Power is greater than 1450

```

L   PIW 320
L   1450
>=D
JC   SBT

```

```

L   IW 258
L   10
+D
T   QW 258

```

// Decrease Digital Setpoint until Load Power is less than 1550

```

SBT: L   IW 320
      L   1550
      <=D
      JC   END

```

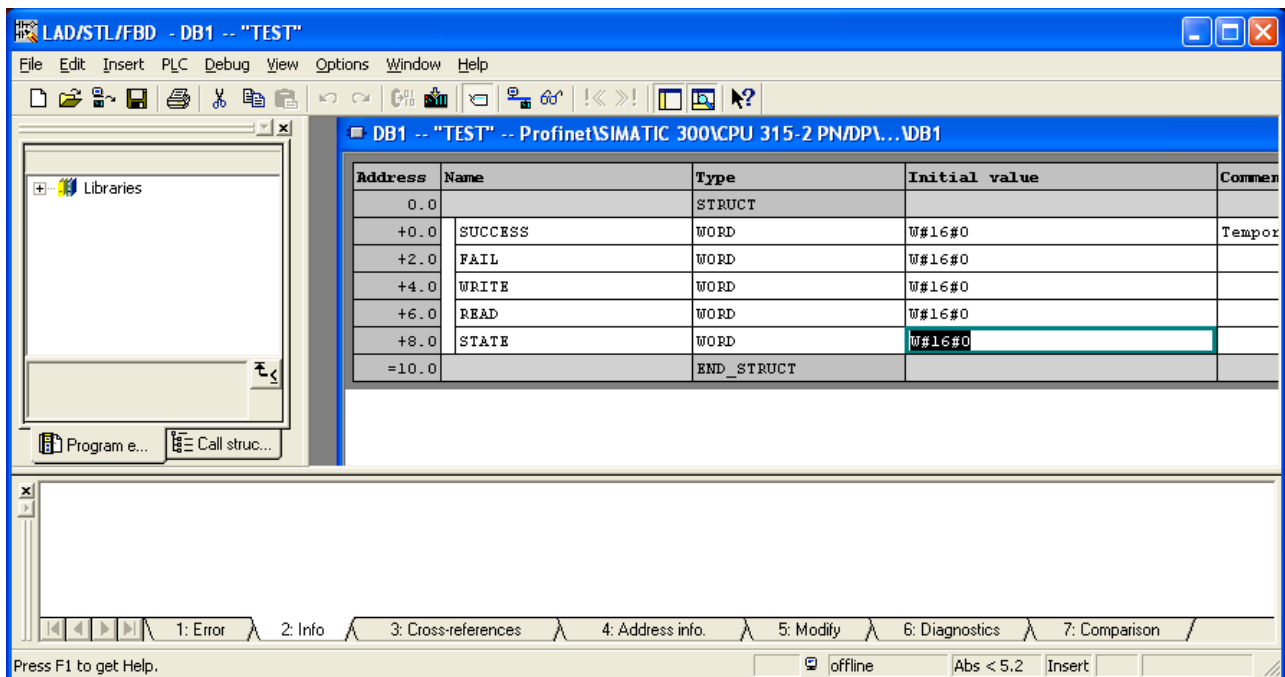
```

L   IW 258
L   10
-D
T   QW 258

```

END: BEU

11) Update Create DB to contain variables SUCCESS, FAIL, WRITE, READ, and STATE.



12) Modify wait time in the event of failure. Current sampling time is roughly 5 Hz.