

CMMT-xx-EP ModbusTCP Server Control via MicroLogix1400 Client PLC

This document provides configuration information for the integration of Festo CMMT-xx-EP Drive/Motor Controllers (Slave/Server) to an Allen Bradley MicroLogix1400 PLC (Master/Client).

CMMT-AS-xx-EP
CMMS-ST-xx-EP

The control method is ModbusTCP protocol.

Any sample code is programmed with RSLogix 500 Rockwell Automation Software.

The FAS (Festo Automation Suite) software is used to configure the CMMT-xx-EP Drive/Motor Controller.

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1 Components/Software/Firmware used

Type/ Name	Version Software/ Firmware	Description
CMMT-AS-C2-3A-EP-S1	Firmware V18.0.5.62	NOTE: V017.0.8.48 or newer REQUIRED for Modbus Function
CMMT-ST-C8-1C-EP-S0	Firmware V18.0.5.88	NOTE: V017.0.7.80 or newer REQUIRED for Modbus Function
Festo Automation Suite	V2.0.1.9	
CMMT-AS Plug-in	V2.0.1.8	
CMMT-ST Plug-in	V2.0.1.8	
RSLogix 500	V12.00.00	Rockwell Automation Software
1766-L32BWA	V21.006	MicroLogix 1400 Series B Controller

Table 1.1: 1 Components/Software used

1.1 Recommended Manuals

A) CMMT-AS Software/Function/Fieldbus/Device Profile Manual


Manual 8093861 - CMMT-AS-SW-EN
 Servo drive - Bus interface - Function - Device profile - Software

 **Manual**
 → File and language versions

Associated products

- servo drive CMMT-AS-C12-11A-P3-EC-S1 (8133355)
- servo drive CMMT-AS-C12-11A-P3-FP-S1 (8133357)

Reference: https://www.festo.com/net/en-gb_gb/SupportPortal/InternetSearch.aspx?q=8093861

B) CMMT-AS Wiring & Installation Manual


Description 8075797 - CMMT-AS-C2_4-3A-EN
 Servo drive - Assembly - Installation - Safety function

 **Description**
 → File and language versions

Associated products

- servo drive CMMT-AS-C2-3A-EC-S1 (5340819)
- servo drive CMMT-AS-C2-3A-FP-S1 (5340824)

Reference: https://www.festo.com/net/en-gb_gb/SupportPortal/InternetSearch.aspx?q=8075797

C) CMMT-AS Wiring & Installation Safety Function Manual


Description 8075815 - CMMT-AS-S1-EN
 Safety function - SBC - SS1 - STO

 **Description**
 → File and language versions

Associated products

- servo drive CMMT-AS-C12-11A-P3-EC-S1 (8133355)
- servo drive CMMT-AS-C12-11A-P3-FP-S1 (8133357)

Reference: https://www.festo.com/net/en-gb_gb/SupportPortal/InternetSearch.aspx?q=8075815

D) CMMT-AS Short Documentation/Quick Guide Manual


Short documentation 8100291 - CMMT-AS-3A-QUICKGUIDE-EN
 Servo drive - Quick guide

 **Short documentation**
 → File and language versions

Associated products

- servo drive CMMT-AS-C2-3A-EC-S1 (5340819)
- servo drive CMMT-AS-C2-3A-FP-S1 (5340824)

Reference: https://www.festo.com/net/en-gb_gb/SupportPortal/InternetSearch.aspx?q=8100291

E) CMMT-ST Software/Function/Fieldbus/Device Profile Manual

**Description 8097138 - CMMT-ST-SW-EN**
Servo drive - Bus interface - Device profile - Software - Function

 Description
→ File and language versions

Associated products

- servo drive CMMT-ST-C8-1C-EC-S0 (8084005)
- servo drive CMMT-ST-C8-1C-EP-S0 (8084006)
- servo drive CMMT-ST-C8-1C-PN-S0 (8084004)

Reference:

https://www.festo.com/net/en-gb_gb/SupportPortal/Downloads/565457/700682/CMMT-ST-SW_description_2019-10c_8123478g1.pdf

F) CMMT-ST Wiring & Installation Manual

**Description 8097120 - CMMT-ST-C8-1C-_-S0-EN**
Servo drive - Installation - Assembly

 Description
→ File and language versions

Associated products

- servo drive CMMT-ST-C8-1C-EC-S0 (8084005)
- servo drive CMMT-ST-C8-1C-EP-S0 (8084006)
- servo drive CMMT-ST-C8-1C-PN-S0 (8084004)

Reference:

https://www.festo.com/net/en-gb_gb/SupportPortal/Downloads/544124/697430/CMMT-ST-C8-1C-_-S0_description_2019-10a_8113757g1.pdf

G) CMMT-ST Wiring & Installation Safety Function Manual

**Description 8097129 - CMMT-ST-C8-1C-_-S0-EN**
Servo drive - SS1-t - STO - safety sub-function

 Description
→ File and language versions

Associated products

- servo drive CMMT-ST-C8-1C-EC-S0 (8084005)
- servo drive CMMT-ST-C8-1C-EP-S0 (8084006)
- servo drive CMMT-ST-C8-1C-PN-S0 (8084004)

Reference:

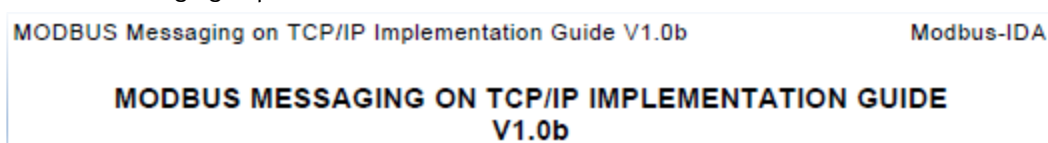
https://www.festo.com/net/en-gb_gb/SupportPortal/Downloads/544132/697438/CMMT-ST-C8-1C-_-S0_description_2019-10a_8113766g1.pdf

H) Modbus Application Protocol Specification V1.1.b3



Reference: http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf

I) Modbus Messaging Implementation Guide V1.0b



Reference: http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf

1.2 Attachments/Dependencies

Directory: App Data

Description: Application Guide

Filename: CMMT-AS-EP x1 + MicroLogix1400 + ModbusTCP + Tel_111 + PTP + App Note.pdf

Directory: App Data

Description: Interpretation of the PROFIdrive Specification modified to relate to the data tables within the Rockwell RS500 project file

Filename: PROFIdrive Specification for MicroLogix1400 ModbusTCP ca0pro.xlsx

Directory: FAS\CMMT_ModbusTCP_FASPlugV2.0.1.8

Description: Festo Automation Suite (FAS) project which compliments the PLC program.

Filename: CMMT_ModbusTCP_FASPlugV2.0.1.8.fsp

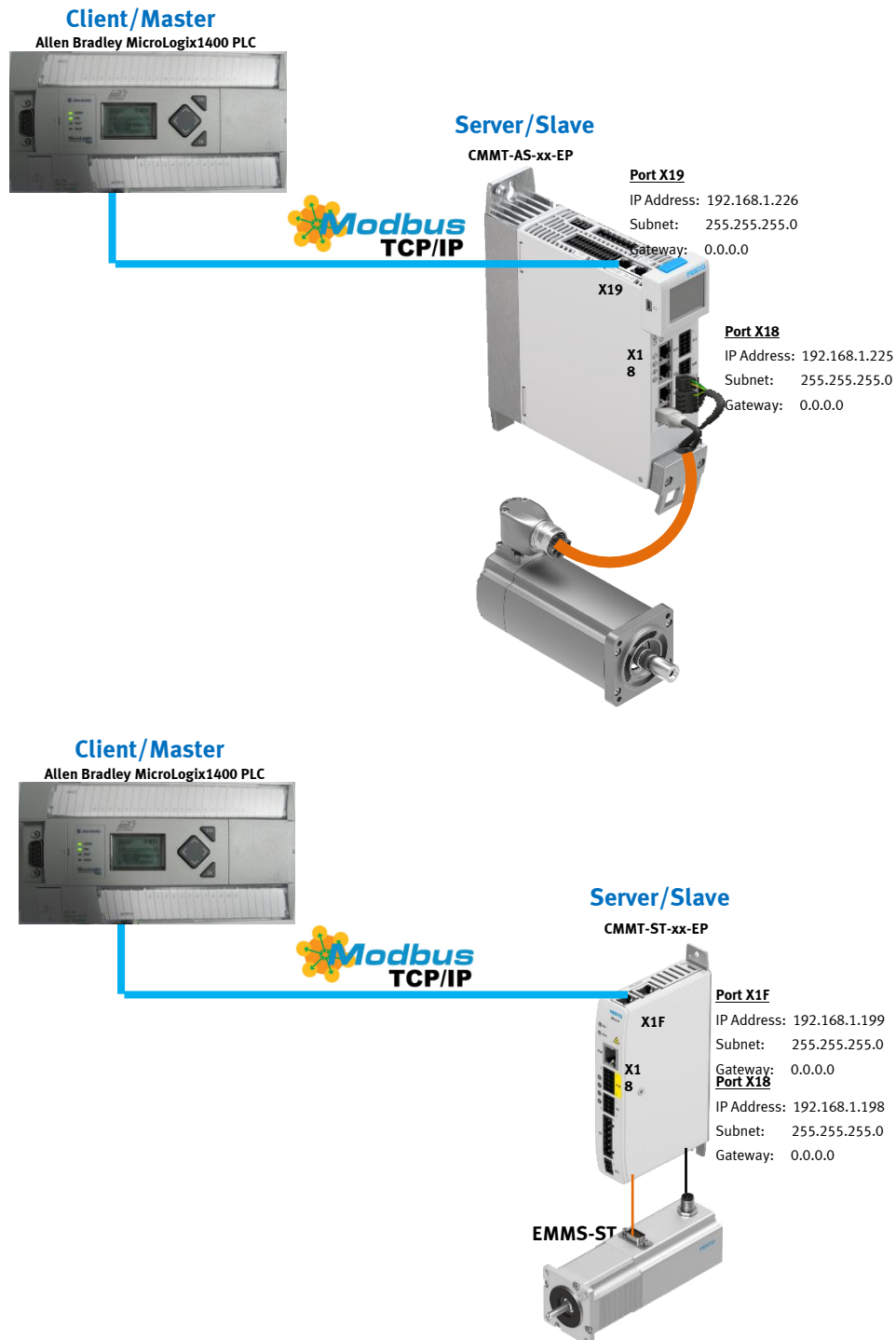
Directory: PLC

Description: Rockwell RS500 project file.

Filename: CMMT_Tel111_ModbusTCP_Server_to_Micrologix1400B_Client.RSS

1.3 Network Topology of the tested systems

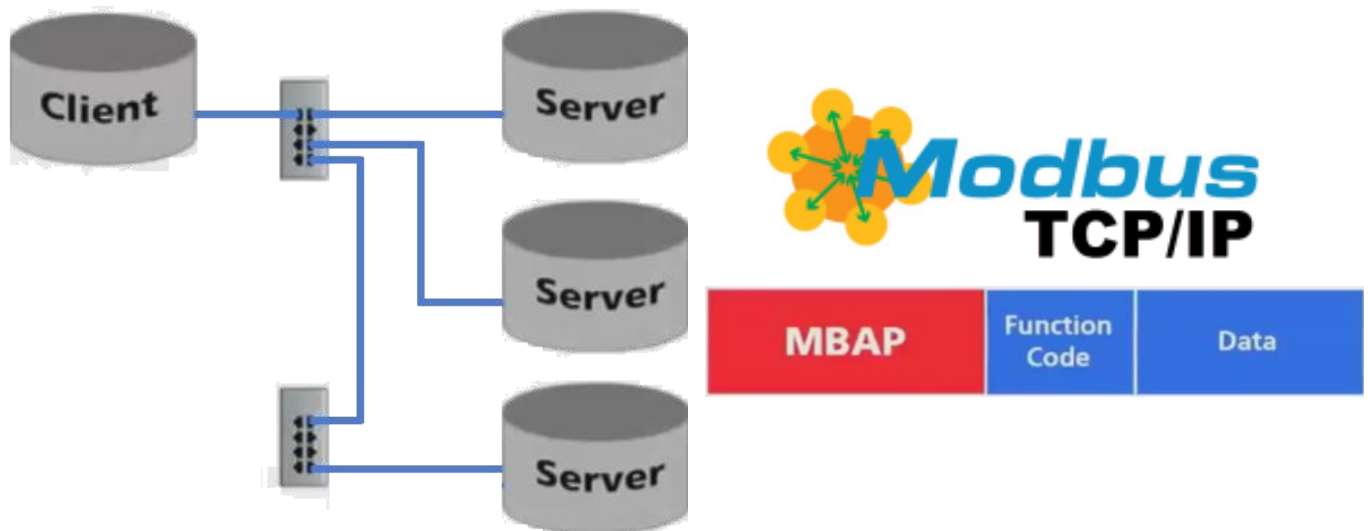
Please refer to the picture below and make sure all wires are correctly placed and connected. The user manuals (reference provided in section 1.1 Recommended Manuals) will need to be referenced for other wiring not shown here.



2 Modbus TCP/IP

The CMMT-xx-EP (EtherNet/IP or Modbus TCP) supports Modbus TCP as alternative Industrial Ethernet protocol.

Modbus TCP over EtherNet uses standard EtherNet cables and switches to communicate with each other. With Modbus TCP/IP a “MBAP (Modbus Application Header)” is added to the start of each message. **Port 502** is used for Modbus TCP/IP Communication.



Standard **Internet Protocol Addressing** is used. The IP Address (required) is the location of the device on the network and the Subnet Mask (required) simplifies the task of routing traffic in the network. The Default gateway is NOT required when a gateway does not exist.

Internet Protocol Addressing Example:

IP Address: 192.168.1.54
 Subnet Mask: 255.255.255.0
 Default Gateway: 192.168.1.2 (alternatively 0.0.0.0)

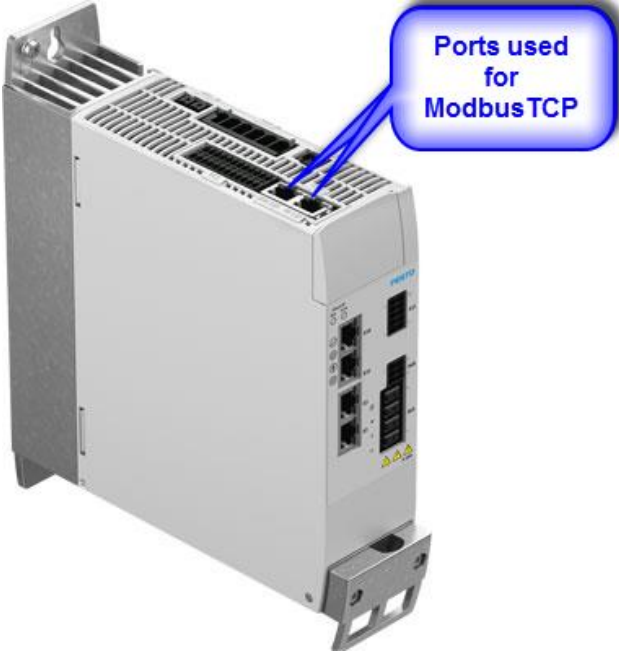
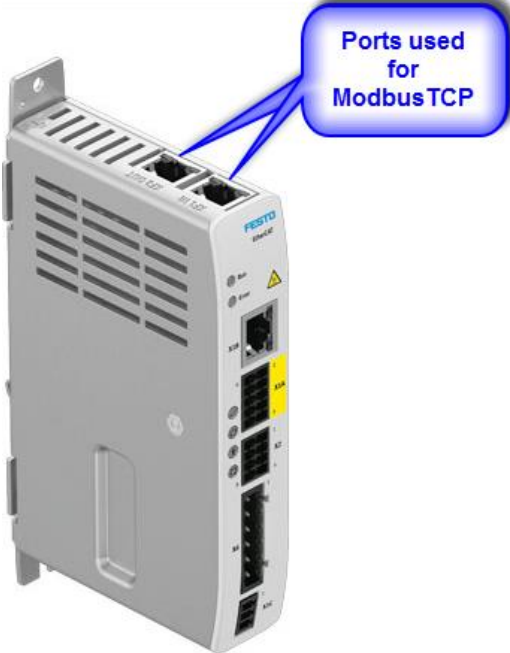
2.1 Function Code Support

NOTE: The Green highlights represent the CMMT-xx-EP (Modbus TCP) “**SUPPORTED FUNCTION CODES**”

Function Code	Name	Data level	Description
01	Read Coils	Bit level	This function code is used to read from 1 to 2000 contiguous status of coils in a remote device. The coils in the response message are packed as one coil per bit of the data field
02	Read Discrete Inputs		This function code is used to read from 1 to 2000 contiguous status of discrete inputs in a remote device. The discrete inputs in the response message are packed as one input per bit of the data field
05	Write Single Coil		This function code is used to write a single output to either ON or OFF in a remote device
15	Write Multiple Coils		This function code is used to force each coil in a sequence of coils to either ON or OFF in a remote device
03	Read Holding Registers	Word (16-bit) level	This function code is used to read the contents of a contiguous block of holding registers in a remote device
04	Read Input Registers		This function code is used to read from 1 to approximately 120 contiguous input registers in a remote device
06	Write Single Register		This function code is used to write a single holding register in a remote device
16	Write Multiple Registers		This function code is used to write from 1 to approximately 120 contiguous registers in a remote device
22	Mask Write Register		This function code is used to modify the contents of a specified holding register using a combination of an AND mask, an OR mask, and the register's current contents. The function can be used to set or clear individual bits in the register.
23	Read/Write Multiple Registers		This function allows the input/output of a range of registers as a single transaction
20	Read File Record	File Record Access	This function code is used to perform a file record read. All Request Data Lengths are provided in terms of number of bytes and all Record Lengths are provided in terms of registers.
21	Write File Record		This function code is used to perform a file record write. All Request Data Lengths are provided in terms of number of bytes and all Record Lengths are provided in terms of the number of 16-bit words.
43	Read Device Identification	Encapsulated interface	This function code is used to read the Device Identification

2.2 **Firmware Support**

Support for ModbusTCP with the CMMT-xx-EP controllers only started with the following firmware versions.
The Modbus connection can be implemented via the shown interface Real-time Ethernet (RTE) port 1 and port 2

CMMT-AS-EP	CMMT-ST-EP
FW (Firmware): CMMT-AS-EP-S1-V017.0.8.48_release.pck	FW (Firmware): CMMT-ST-EP-V017.0.7.80_release.pck
	

2.3 Port Setting and Timeout

- After switch-on, the device waits for an EtherNet/IP or a Modbus TCP telegram. As soon as the device receives a corresponding telegram, the other protocol is deactivated.
- TCP port 502 (standard port for Modbus TCP)
- The **DEFAULT** timeout (connection to detect an interruption of the Modbus and switch to a corresponding status) in the CMMT is **100ms**.



Note

- If the **100ms** timeout is not acceptable to your application, the registers to modify this are 400-401

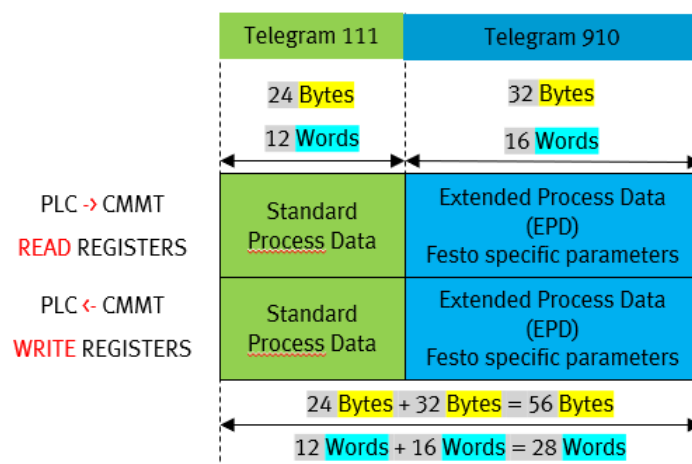
2.4 Process Data

The process data is transmitted at a minimum transmission rate of **1ms**.

CMMT ModbusTCP combined Telegram **111** and **910** Channel settings and Starting Address **Offset**
If the EPD (Telegram **910**) is deactivated in Festo Automation Suite, only zeros are transmitted.

Read Register : The data has to be read (Function Code 3) from the address **0x0064 Hex (100 Decimal)**.
The length of the data to be read must be a fixed length of **28 Words** (Telegram **111** and **910**).

Write Register : The data has to be written ((Function Code 16) from the address **0x0000 Hex**.
The length of the data to be read must be a fixed length of **28 Words** (Telegram **111** and **910**).



2.5 Data Map (Telegram 111)

The green highlighted bits are among the most common used.

P/P MODE																		
NOTE: Telegram 111 is a SIEMENS specific extension of PROFIDrive. (Siemens telegram 111)																		
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0	
INPUT	N94:0	ZSW1	Device specific	Device specific	Drive Stopped AxisSpFixed	ZSW1.12 Traverse Task Acknowledge AxisAckSetpoint FAS P1.1145121	ZSW1.11 Home/Reference Has been Set/Completed AxisRef	ZSW1.10 Target Position Reached AxisPosOk FAS P1.1145101	PLC Control Requested	Following Error Within Tolerance Range	ZSW1.7 Warning Active AxisWarn	ZSW1.6 Switch On Inhibited Lockout	Quick Stop Not Active	Coast Stop Not Active	ZSW1.3 Fault Active AxisError	ZSW1.2 Operation Enabled AxisEnabled	ZSW1.1 Ready To Operate sbReady	Ready to Switch On
	N94:1	POS_ZSW1 or Epos_ZSW1	MDI Active Selection 0=Record Mode 1=Direct Mode	- FW Pending - MDI Setup Active	Position Record Task Is Active	- FW Pending - Flying Reference Active	Homing Task Is Active	Jogging Task Is Active	Positive Hardware Limit Switch is Activated	Negative Hardware Limit Switch is Activated	Reserved B7	Position Record Selected Bit 6	Position Record Selected Bit 5	Position Record Selected Bit 4	Position Record Selected Bit 3	Position Record Selected Bit 2	Position Record Selected Bit 1	Position Record Selected Bit 0
	N94:2	POS_ZSW2 or Epos_ZSW2	Traversing Task is Active	POS_ZSW2.14 Move to Fixed Stop Active	POS_ZSW2.13 Fixed Stop Clamping Torque Reached	POS_ZSW2.12 Fixed Stop Reached	Direct Output 2 Via Positioning Record	Direct Output 1 Via Positioning Record	Actual Position via Cam Switch Position 1	Actual Position via Cam Switch Position 0	Positive Software Limit Switch is Activated	Negative Software Limit Switch is Activated	Axis is Moving Negative	Axis is Moving Positive	- FW Pending - Printing Mark outside window	POS_ZSW2.2 Ready to Accept new Setpoint	Velocity Limit is Active	Tracking Mode is Active
	N94:3	ZSW2	Sign-Of-Life				Device specific	Device specific	Device specific	ZSW2.8 Travel to Fixed Stop is Active	Device specific	Device specific	Device specific	Device specific	Device specific	Device specific	Device specific	Device specific
	N94:4	MELDW	Reserved B15	Reserved B14	Pulses Enabled	Drive Ready	Controller Enable	Reserved B10	Reserved B9	Speed Setpoint - Actual Deviation Within tolerance	No alarm, thermal overload, power unit	No motor over-temperature alarm	Variable signaling function	Reserved B4	Setpoint(n) < speed threshold value 2	Setpoint(n) < speed threshold value 3	Torque[%]<torque threshold value 2	0 = Ramping Active 1 = Ramping Completed
	N94:5	XIST_A	Actual Position Value FAS P1.128															
	N94:6	XIST_A	Actual Velocity Value															
	N94:7	XIST_B	Actual Velocity Value															
	N94:8	XIST_B	Actual Velocity Value															
	N94:9	FAULT_CODE	Active Fault Number															
	N94:10	WARN_CODE	Active Warning Number															
	N94:11	Reserved	Not Used															
OUTPUT	N95:0	STW1	Device specific	Device specific	Device specific	STW1.12 Release Holding Brake ConfigEPOS.15 FAS P1.1147120	STW1.11 Home/Reference Task Start (Execute FAS Home Method)	Control By PLC (Programmable Logic Controller)	Jog2	Jog1	STW1.7 Fault Acknowledge AckError	STW1.6 Traversing Task Activate ExecuteMode FAS P1.1147061	STW1.5 Intermediate Stop Disable IntermediateStop	STW1.4 Traversing Task Enable CancelTraversing	STW1.3 Enable Operation	STW1.2 Quick Stop Disable ConfigEPOS.1 FAS P1.1147020	STW1.1 Coast Stop Disable ConfigEPOS.0 FAS P1.1147010	STW1.0 Power Stage Pulses Enable EnableAxis
	N95:1	POS_STW1 or Epos_STW1	POS_STW1.15 MDI Selection 0=Record Mode 1=Direct Mode	signal Setup Selected	Reserved B13	Constant Takeover	Reserved B11	0 = Absolute positioning through the shortest distance 1 = Absolute positioning/MDI direction selection, positive 2 = Absolute positioning/MDI direction selection, negative 3 = Absolute positioning through the shortest distance	POS_STW1.8 Direct Mode Absolute Positioning Active	Reserved B7	Position Record Select Bit 6	Position Record Select Bit 5	Position Record Select Bit 4	Position Record Select Bit 3	Position Record Select Bit 2	Position Record Select Bit 1	Position Record Select Bit 0	
	N95:2	POS_STW2 or Epos_STW2	POS_STW2.15 Hardware Limits Enable ConfigEPOS.3 FAS=P1.112414150	POS_STW2.14 Software Limits Enable ConfigEPOS.2 FAS=P1.112414140	Reserved B13	Reserved B12	POS_STW2.11 Touch Probe Edge 0 = Rising edge 1 = Falling edge ConfigEPOS.4 FAS=P1.112414110	POS_STW2.10 Select Touch Probe 0 = Probe 1 Active 1 = Probe 2 Active ConfigEPOS.5 FAS=P1.112414100	Start Reference Search 0 = positive direction 1 = negative direction	Reference Select 1 = Flying Reference 0 = Search Reference	Reserved B7	Reserved B6	Jogging 1 = incremental 0 = velocity	Reserved B4	Reserved B3	POS_STW2.2 Reference Cam Active ConfigEPOS.6 FAS=???	POS_STW2.1 Home/Reference Task Start (Set Actual Position = Zero)	Tracking Mode Active
	N95:3	STW2	Master Sign-Of-Life				Motor Switchover Completed	Reserved B10	Global Trigger Command	STW2.8 Travel to Fixed EndStop Enable ConfigEPOS.30 FAS P1.1148080	Parking Axis Enable	Reset I-Component	Global Start	DDS Bit 4	DDS Bit 3	DDS Bit 2	DDS Bit 1	DDS Bit 0
	N95:4	OVERRIDE	Position Velocity Override															
	N95:5	MDI_TARPOS	MDI (Manual Data Input) Position Target FAS P1.11280604															
	N95:6	MDI_TARPOS	MDI (Manual Data Input) Position Target FAS P1.11280604															
	N95:7	MDI_VELOCITY	MDI (Manual Data Input) Velocity Target FAS P1.11280604															
	N95:8	MDI_VELOCITY	MDI (Manual Data Input) Velocity Target FAS P1.11280604															
	N95:9	MDI_ACC	MDI Percent Acceleration															
	N95:10	MDI_DEC	MDI Percent Deceleration															
	N95:11	Reserved	Not Used															

2.6 PROFIdrive over ModbusTCP

The Festo CMMT-xx-EP motor controllers have been implemented with PROFIdrive over ModbusTCP. PROFIdrive use "Telegrams" each containing cyclic parameters unique to the application class type for data exchange between PLC and the Drive/Motor Controller.

The Festo CMMT-xx-EP ModbusTCP Drive/Motor Controllers support Telegrams 1, 102 and 111.



Note

- **Note:** Other than this what is shown in this section, within this guide, we only discuss Telegram 111.

Telegram #	Telegram Type	Function
1	Standard	Basic Speed Control
102	Siemens	Advanced Speed Control
111	Siemens	EPOS mode Position Control (Point to Point Non-Interpolated Motion)

In addition to PROFIdrive Telegrams, a manufacturer-specific (Festo) additional telegram 910 is available for transmitting additional/optional Extended Process Data. The Extended Process Data allows the user to configure up to 32 bytes of cyclic parameter data to be exchanged between the PLC and the Drive/Motor Controller.

The Extended Process Data is configured within FAS (Festo Automation Suite) software.

Telegram #	Telegram Type	Function
Not Applicable	Festo	Extended Process Data

2.6.1 Telegram 1 (Basic Speed Control)



WORD	INPUT	OUTPUT
1.	Control Word 1	Status Word 1
2.	Speed Setpoint Value	Actual Speed Value

2.6.2 Telegram 102 (Advanced Speed Control)



WORD	INPUT	OUTPUT
1.	Control Word 1	Status Word 1
2.	Speed Setpoint	Speed Actual
3.		
4.	Control Word 2	Status Word 2
5.	Torque Reduction	MELDW Status Word
6.	Encoder Control Word 1	Encoder Status Word 1
7.		Encoder Position G1_XIST1
8.		
9.		Encoder Position G1_XIST2
10.		

2.6.3 Telegram 111 (Position Control)



WORD	INPUT	OUTPUT
1.	Control Word 1	Status Word 1
2.	Pos Control Word 1	Pos Status Word 1
3.	Pos Control Word 2	Pos Status Word 2
4.	Control Word 2	Status Word 2
5.	Velocity Override	MELDW Status Word
6.	MDI Position Setpoint	Position Actual Value
7.		
8.	MDI Velocity Setpoint	Velocity Actual Value
9.		
10.	MDI Percent Acceleration	Active Fault Number
11.	MDI Percent Deceleration	Active Warning Number
12.	User Selectable	User Selectable

2.6.4 Telegram 910 (Extended Process Data, EPD)



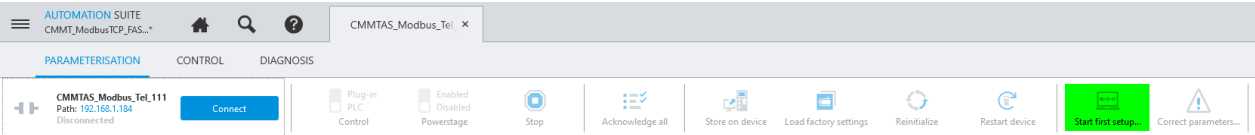
PZD	Setpoint value (Rx data)	Actual value (Tx data)
1	Max. 8 parameters (32 bytes)	Max. 8 parameters (32 bytes)
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

3 Festo Automation Suite Configuration

It is assuming the user understands how to use Festo Automation Suite to configure the base project of hardware and that this is done before moving to the next step.

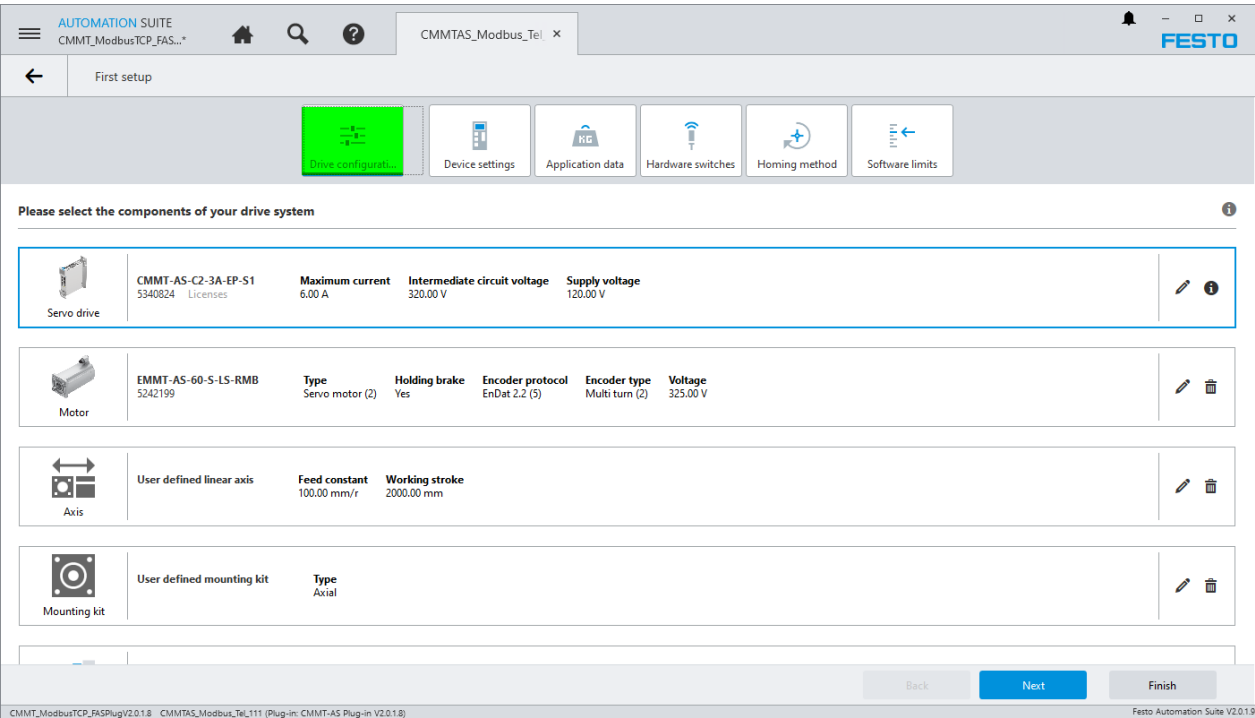
3.1 First Setup

This feature is used to provoke the user to think about important parameters while configuring the CMMT.



3.1.1 Drive Configuration

The picture below shows the configuration this application note was tested with. The user will have their own unique hardware and need to enter this data here.



3.1.2 Device Settings

The user needs to consider the AC Supply voltage and the IP Address of the individual controller. The selection of Telegram **111** is mandatory in this guide.

The screenshot shows the 'Device settings' tab selected in the Festo Automation Suite. The window title is 'CMMTAS_Modbus_Tel'. The 'First setup' button is visible. The configuration is divided into several sections:

- Enable servo drive:** Activation via is set to 'I/O and fieldbus (0)'.
- Configuration:**
 - Activate DHCP: ☐ Active
 - IP address: 192 . 168 . 0 . 185
 - Subnet mask: 255 . 255 . 255 . 0
 - Gateway address: 0 . 0 . 0 . 0
- Telegram:** Telegram selection is set to 'Telegram (111)'.
- Supply voltage:** Supply voltage is set to 120.00.
- DC Link:**
 - Warning: If the DC circuit is linked to that of another drive, the rapid discharge function needs to be deactivated in order to protect the device.
 - Rapid discharge: ☒ Active

Navigation buttons at the bottom: Back, Next, Finish. The status bar at the bottom indicates 'CMMT_ModbusTCP_FASPlug V2.0.1.8' and 'Festo Automation Suite V2.0.1.8'.

3.1.3 Hardware Switches

The picture below shows the configuration this application note was tested with. The user will have their own unique hardware and need to enter this data here.

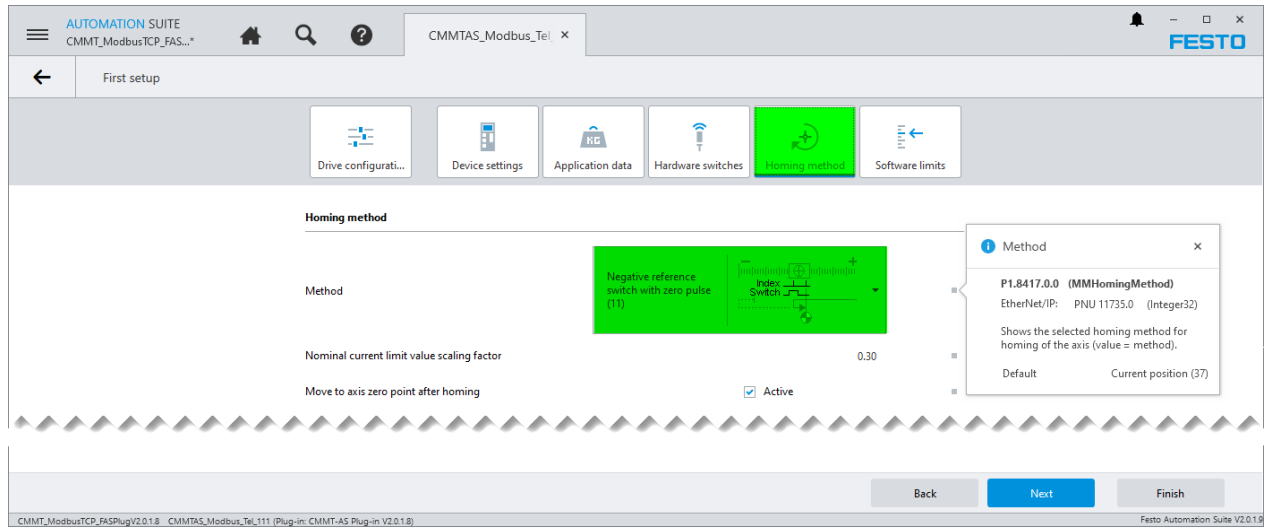
The screenshot shows the 'Hardware switches' tab selected in the Festo Automation Suite. The window title is 'CMMTAS_Modbus_Tel'. The 'First setup' button is visible. The configuration is divided into several sections:

- Hardware switches:**
 - Reference switch configuration: N/C contact (2)
 - Limit switches configuration: Normally Closed (NC)

Navigation buttons at the bottom: Back, Next, Finish. The status bar at the bottom indicates 'CMMT_ModbusTCP_FASPlug V2.0.1.8' and 'Festo Automation Suite V2.0.1.8'.

3.1.4 Homing Method

The picture below shows the configuration this application note was tested with. The user will have their own unique hardware and need to enter this data here.



3.1.5 Correct Parameters Assistant

The software checks whether the entered parameter values are within calculated limits. Marking of limit value violations can be seen by color and the meaning is as follows:

Colour of the adorning	Meaning	Description
Orange	Warning	Limit value violation is tolerated and can be loaded into the device. Warnings should be corrected.
Red	Error	Limit value violations are not tolerated and cannot be loaded into the device. Errors must be corrected.



Note: It is recommended to checking all existing limit value violations and complying with the calculated limit values.

The assistant for parameter correction is started using the ‘Correct parameters’ button in the toolbar. If the plug-in is connected to the device or there is no limit value violation, the button is de-activated.

Automation Suite
CMMTAS_Modbus_Tel_111
Path: 192.168.0.1
Disconnected

PARAMETERISATION CONTROL DIAGNOSIS

CMMTAS_Modbus_Tel_111
Path: 192.168.0.1
Disconnected

Connect

Parameter pages < Drive configuration Further information

Drive configuration

Please select the components of your drive system

	CMMT-AS-C2-3A-EP-S1 5340824 Licenses	Maximum current 6.00 A	Intermediate circuit vc 320.00 V	
	EMMT-AS-60-S-LS-RMB 5242199	Type Servo motor (2)	Holding brake Yes	Encoder EnDat 2.1

User defined mounting kit

Overview

Correct parameters

ID	Name	Actual value	Recommended value	Unit
P1.842.0.0	Homing timeout	60.00	200.00	s
P1.850.0.0	Lower limit value velocity (closed loop controller)	-16666670000000000000000000000000.00	-7.584135	m/s
P1.851.0.0	Upper limit value velocity (closed loop controller)	16666670000000000000000000000000.00	7.584135	m/s
P1.852.0.0	Lower limit value torque (closed loop controller)	-10000000000000000000000000000000.00	-2.214	Nm
P1.853.0.0	Upper limit value torque (closed loop controller)	10000000000000000000000000000000.00	2.214	Nm
P1.854.0.0	Lower limit value active current (closed loop control...)	-10000000000000000000000000000000.00	-5.40	Arms
P1.855.0.0	Upper limit value active current (closed loop control...)	10000000000000000000000000000000.00	5.40	Arms
P1.856.0.0	Limit value total current (closed loop controller)	10000000000000000000000000000000.00	5.40	Arms
P1.1305.0.0	Upper limit value acceleration limitation	56713670000000000000000000000000.00	100.00	m/s²
P1.1306.0.0	Upper limit value deceleration limitation	56713670000000000000000000000000.00	100.00	m/s²
P1.1310.0.0	Limit value velocity limit negative direction of move...	-56713670000000000000000000000000.00	-7.584135	m/s
P1.4660.0.0	Maximum velocity	16.666	7.584135	m/s

Apply **Cancel**

3.2 Device Communication

3.2.1 Network Settings for X18 Programming Port

Selection of the Scan tab will provoke a scan of the network for all connected devices.

The user can then assign an IP Address to the port (NOTE: This is NOT the EtherNet/IP Port which is configured in the project shown earlier in this guide)

The screenshot shows the Festo Automation Suite interface. The top bar includes the 'AUTOMATION SUITE' logo and several tabs: 'CMMTAS_Modbus_Tel_111' and 'CMMTST_Modbus_Tel_111'. The main area is divided into a 'Device list' table and a right-hand panel for 'CMMTAS-Modbus_Tel_111'.

Status	Device Name	Device Type	Address	Subnet Mask	Firmware
⊗	CMMTST_Modbus_Tel_111	CMMT-ST-C8-1C-EP-S0	192.168.1.176	255.255.255.0	V18.0.5.88_release
ⓘ	CMMTST_EP	CMMT-AS	192.168.1.177	255.255.255.0	1.0.13-49633e4bd.20200525
ⓘ	CMMTAS_Modbus_Tel_111	CMMT-AS-C2-3A-EP-S1	192.168.1.184	255.255.255.0	V18.0.5.62_release
ⓘ	CMMTAS_X19_EIP_Axis_X	CMMT-AS	192.168.1.185	255.255.255.0	1.0.13-49633e4bd.20200525
ⓘ	CPX-E-CEC-C1-EP	CPX-E-CEC-C1-EP	192.168.1.212	255.255.255.0	1.1.24-23349574d.20191213

The right-hand panel for 'CMMTAS-Modbus_Tel_111' shows a device image and 'Network Settings'. The settings include:

- DHCP: ☐ Enable
- Address: 192.168.1.184
- Subnet Mask: 255.255.255.0
- Gateway: 0.0.0.0
- DNS: 0.0.0.0

At the bottom of the panel is a blue button labeled 'Activate New Settings'.

3.2.2 Select Path to Controller

The user must select the path to the controller as shown by example here.

The screenshot shows the Festo Automation Suite interface with the 'PARAMETERISATION' tab selected. A 'Device Communication' dialog box is open, prompting the user to enter the device's IP address or select a device from the list below. The IP address field is set to '192.168.1.184'.

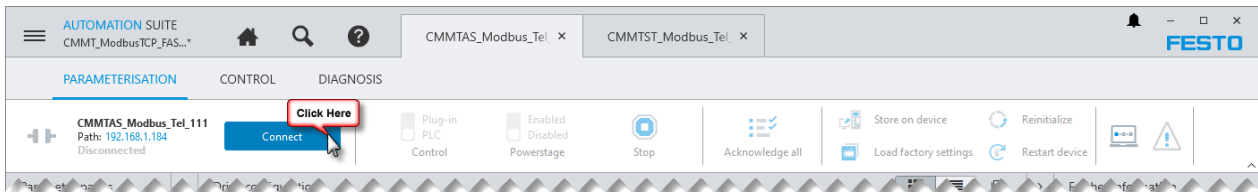
The 'Available Devices' table is shown below the IP address field:

Status	Identify	Device Name	Device Type	Address
⊗	●	Tel_111_Demo1_CM...	CMMT-AS-C2-3...	192.168.1.184

At the bottom of the dialog box is a blue button labeled 'Use IP Address for Device Communication'.

3.2.3 Download Project Configuration to Controller

To download the project, select Connect,

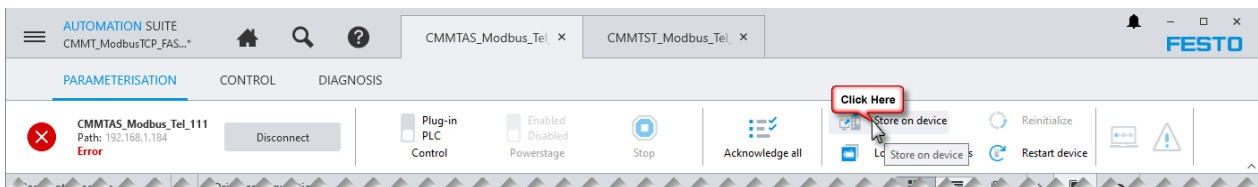


Select "Write to Device"

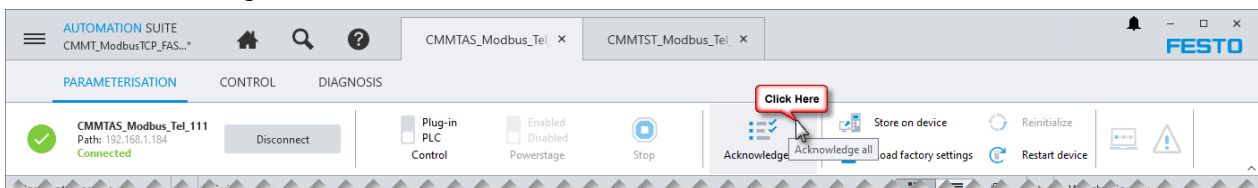
i Device contains no parameter data
The device contains no parameter data. Parameters will be transferred from the project to the device.



Click the "Store to Device" button



Click the "Acknowledge All" button to clear all alarms.



The Controller should now be ready for commissioning.

4 Allen Bradley MicroLogix 1400

4.1 Controller Information

The MicroLogix 1400 (1766-L32BWA used in this application example) controller maintain the same critical features as the MicroLogix 1100 controller, and expands that capability with more I/O, faster HSC/PTO, and an additional serial port. MicroLogix 1400 controllers are for applications that require up to 256 digital I/O.



4.2 Features

- Communication Channel 0 provides isolated RS-232 or RS-485
- Communication Channel 1 (RJ45 port) that supports EtherNet/IP (10/100 Mbps) and Modbus TCP.
- Communication Channel 2 provides a 9-pin, non-isolated RS-232 port supporting all serial protocols.

Controller	MicroLogix 1400
Bulletin Number	1766
SCADA RTU - DF1 half-duplex master/slave	✓
SCADA RTU - DF1 radio modem	✓
SCADA RTU - Modbus RTU slave	✓
SCADA RTU - Modbus RTU master	✓
SCADA RTU - DNP3 slave	✓
ASCII - Read/Write	✓
DNP3 over IP	✓
Modbus TCP/IP	✓
Operating Power	
120/240V AC	✓
24V DC	✓
Agency Certifications	
CE, C-Tick, UL, and C-UL (including Class I, Division 2 Hazardous Location) ⁽¹⁾	✓

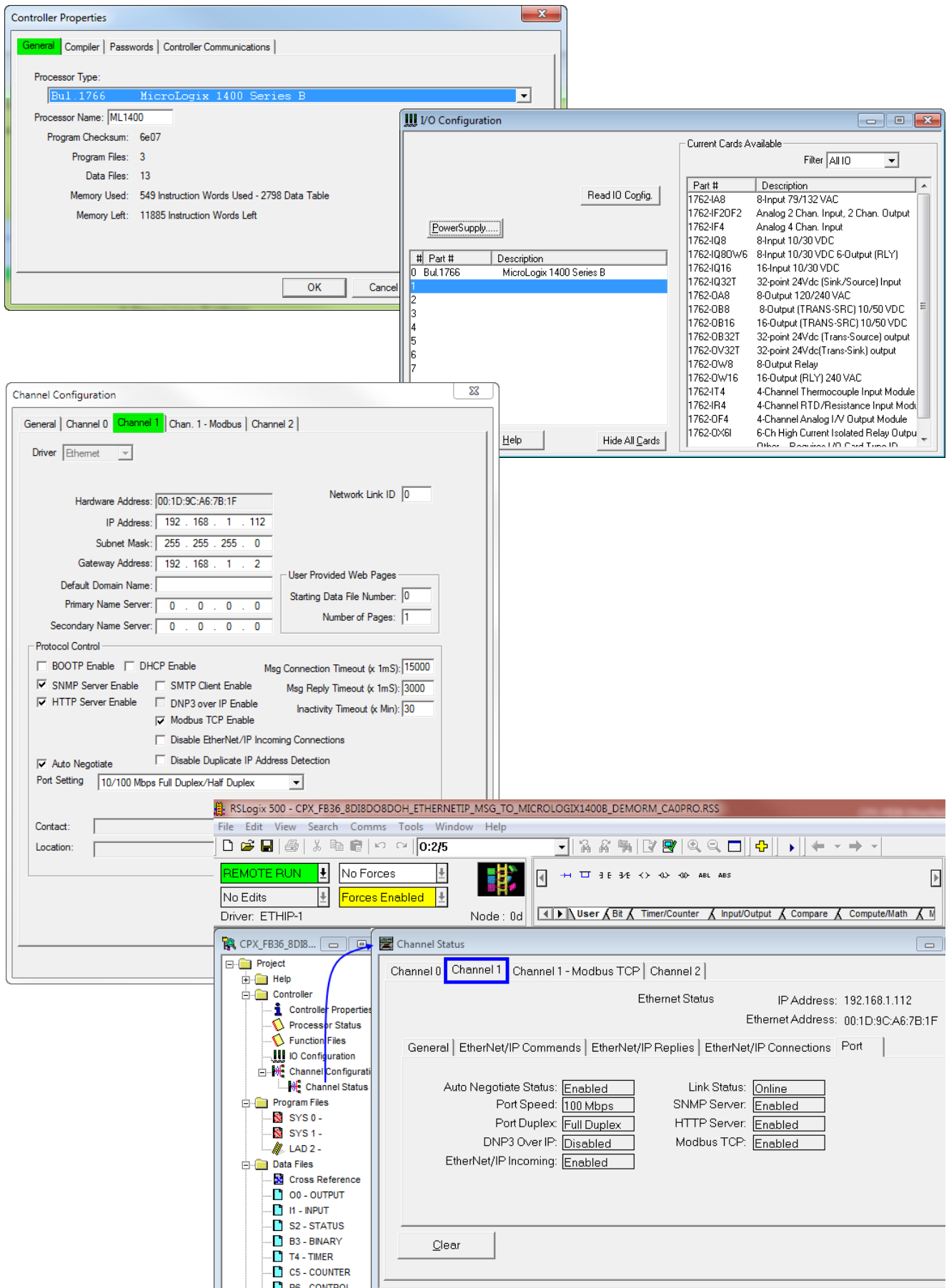
Controller	MicroLogix 1400
Bulletin Number	1766
Memory (in user words)	
Up to 20 KB	10 KB/10 KB
Online editing	✓
Nonvolatile program and data	Battery back-up static RAM
Memory Module (for program back-up and transport)	Optional
I/O	
Embedded Digital I/O, max	32
Embedded Analog I/O	Four 0...10V DC inputs on some controllers Two 0...10V DC outputs on some controllers
Local Expansion I/O, max	256
Thermocouple/RTD	Expansion
Added Functionality	
Trim Potentiometers	Two (digital)
PID	✓
High Speed Counters (embedded)	Up to six @ 100 kHz
Real Time Clock	✓
Motion: Pulse Width Modulated	3 @ 40 kHz
Motion: Pulse Train Outputs	3 @ 100 kHz
Data Access Tool	✓
Data Logging	128 KB
Recipe Storage	Uses up to 64 KB data logging memory
Floating Point Math	✓
Programming	
Windows - RSLogix 500 Software	✓
RSLogix Micro	✓
Communication	
RS-232 Ports	(1) 8-pin mini DIN (1) 9-pin D-shell
DeviceNet Peer-to-Peer Messaging, slave I/O	With 1761-NET-DNI
EtherNet/IP	✓
Web Server Capabilities	✓
DH-485	Network with 1763-NC01

5 Rockwell RSLogix500 Software



5.1 Controller Properties

The IP Address of the controller and other protocol settings were used for this application example.



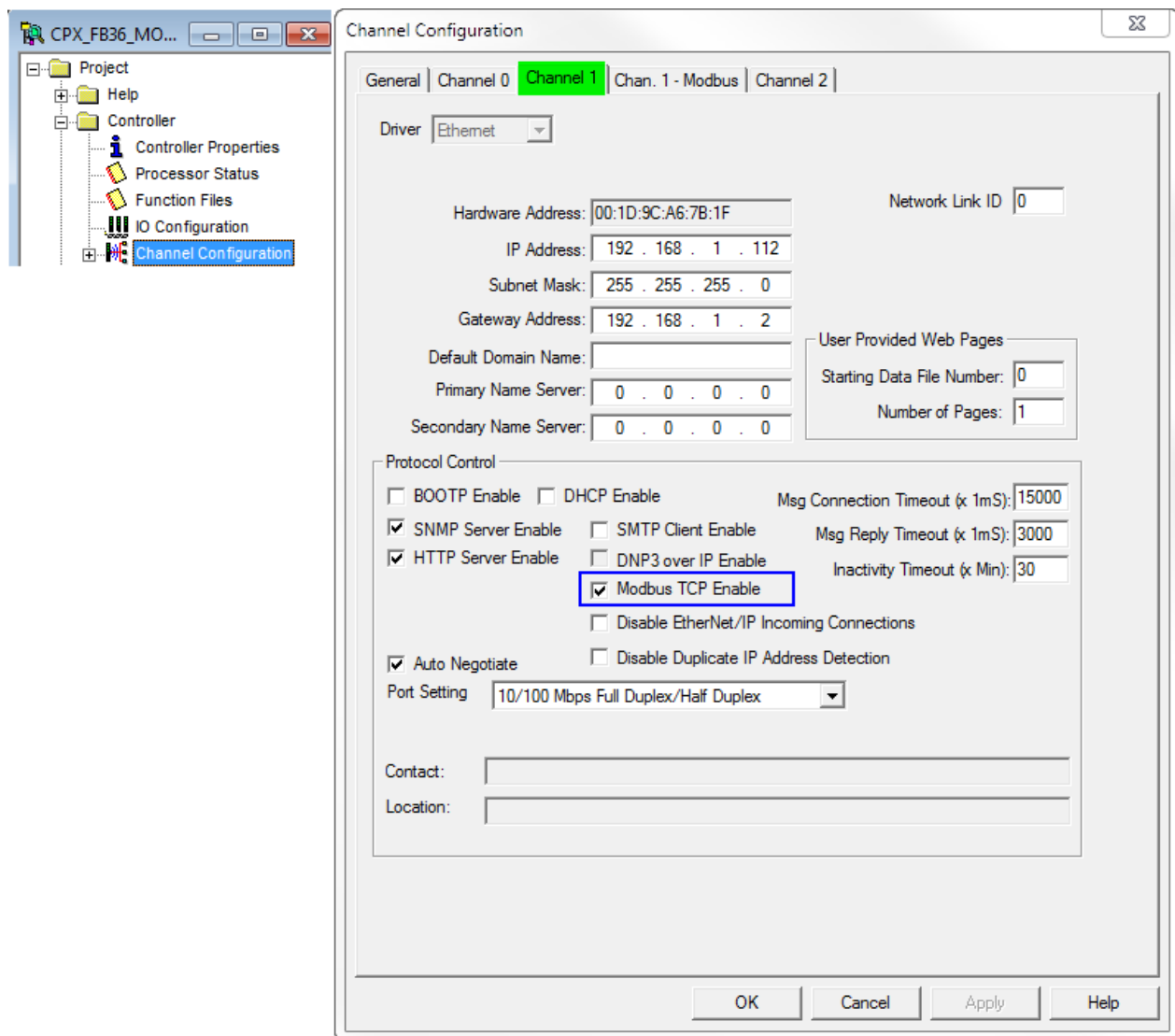
5.2 Channel Configuration

The default communication protocol for the Ethernet Channel 1 in the MicroLogix 1400 is Ethernet/IP. To communicate with Modbus TCP protocol in the MicroLogix 1400 Series B controller, the channel must be configured for this.

To configure this, within the RSLogix 500 software, select the project tree and right click the Channel Configuration and click open.

Select the Channel 1 tab and click to add a checkmark to the Modbus TCP Enable as shown here.

Download this configuration to the PLC controller, then you must **CYCLE POWER TO THE PLC**.



5.3 Sample Code

A RSLogix 500 sample project "CMMT_Tel111_ModbusTCP_Server_to_Micrologix1400B_Client.RSS" is included with this application example.

The programming is to provide example methods for the communication and integration of a Festo CMMT-xx-EP Drive/Motor Controllers (Slave/Server) to an Allen Bradley MicroLogix1400 PLC (Master/Client).

The programming code included is NOT meant to be a full implementation for an application and is a sample only. This is more obvious in the code where "Programmer Bits" are used and the user needs to toggle these to execute types of functions.

To control the CMMT-AS via PROFIdrive, the user manuals (reference provided in section 1.1 Recommended Manuals) should be read and understood.

This guide is not meant to be a substitute to the official Festo literature.

5.3.1 Modbus FC#03 Read Holding Registers

Subroutine: MSG Rungs 1-3:

The MSG instruction uses the ModbusTCP channel to **READ INPUT DATA** from the CMMT-XX-EP into the PLC data table: N94:0 PLC INPUT DATA ← CMMT-XX-EP

MODBUS - FUNCTION CODE #03 - READ HOLDING REGISTERS (INPUTS)
CMMT-xx-EP READ DATA

This MSG uses Channel 1 (Integral, Modbus TCP) to Read Holding Registers from IP Address 192.168.1.185 through port 502

This message will continuously read data based on the following:

Data Table Address: N94:0 (Start Address)
Size In Elements: 28

MSG Read/Write Message
MSG File MG200:0
Setup Screen

Read MSG Faulted
N100:1
0

MG200:0
ER

MG200:0
DN

MG200:0
ER

Data Table Start Address

MSG - MG200:0: (1 Elements)

General

This Controller:
Channel: 1 (Integral, Modbus TCP)
Modbus Command: 03 Read Holding Registers (4xxxxx)
Data Table Address: N94:0
Size in Elements: 28
Data: 16 Bit

Modbus FunctionCode

Data Table Start Address

Data Table Length

Start Register Offset +1

Target Device:
Message Timeout: 33
MB Data Address (1-65536): 101
Unit Identifier: 255
Modbus Address: 40101
Routing Information File(RI): RI201:0
Ethernet (IP) Address: 192.168.1.185
Port: 502
IP Address of CMMT

Control Bits:
Ignore if timed out (TO): 0
Break Connection (BK): 0
Awaiting Execution (EW): 0
Error (ER): 0
Message done (DN): 0
Message Transmitting (ST): 0
Message Enabled (EN): 0

Error:
Error Code(Hex): 0

Error Description:
No errors

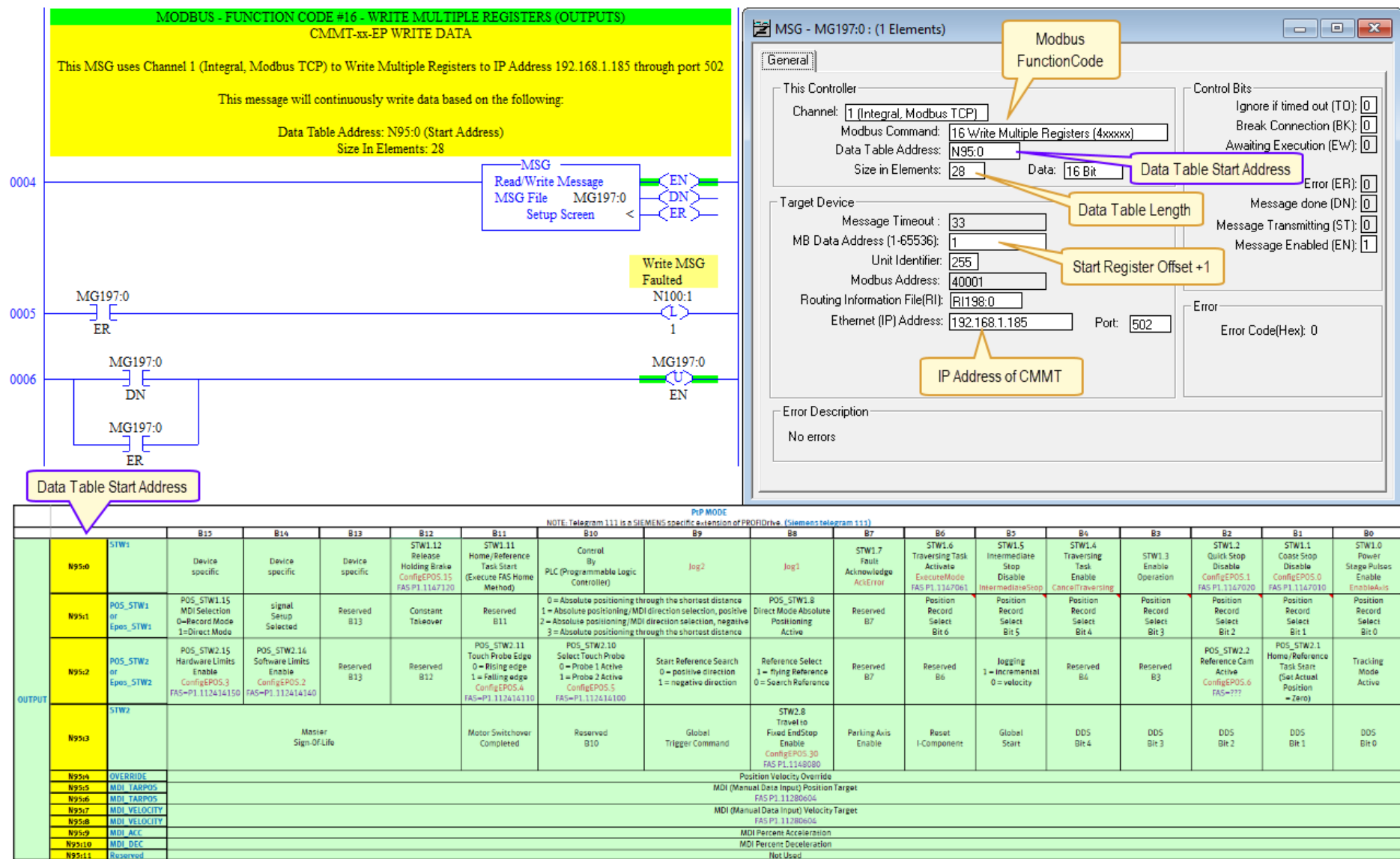
NOTE: Telegram 111 is a SIEMENS specific extension of PROFIDrive. (Siemens telegram 111)

		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0	
INPUT	N94:0	ZSW1	Device specific	Device specific	Drive Stopped Acknowledge	ZSW1.12 Traverse Task Acknowledge	ZSW1.11 Home/Reference Position Reached	ZSW1.10 Target Position Reached	PLC Control Requested	Following Error Within Tolerance Range	ZSW1.7 Warning Active	ZSW1.6 Switch On Inhibited Lockout	Quick Stop Not Active	Coast Stop Not Active	ZSW1.3 Fault Active	ZSW1.2 Operation Enabled	ZSW1.1 Ready To Operate	Ready to Switch On
	N94:1	POS_ZSW1 or Epos_ZSW1	MDI Active Selection 0=Record Mode 1=Direct Mode	-FW Pending- MDI Setup Active	Position Record Task Is Active	-FW Pending- Flying Reference Active	Homing Task Is Active	Jogging Task Is Active	Positive Hardware Limit Switch Is Activated	Negative Hardware Limit Switch Is Activated	Reserved B7	Position Record Selected Bit 6	Position Record Selected Bit 5	Position Record Selected Bit 4	Position Record Selected Bit 3	Position Record Selected Bit 2	Position Record Selected Bit 1	Position Record Selected Bit 0
	N94:2	POS_ZSW2 or Epos_ZSW2	Traversing Task Is Active	POS_ZSW2.14 Move to Fixed Stop Active	POS_ZSW2.13 Fixed Stop Clamping Torque Reached	POS_ZSW2.12 Fixed Stop Reached	Direct Output 2 Via Positioning Record	Direct Output 1 Via Positioning Record	Actual Position Cam Switch Position 1	Actual Position Cam Switch Position 0	Positive Software Limit Switch Is Activated	Negative Software Limit Switch Is Activated	AxIs Moving Negative	AxIs Moving Positive	-FW Pending- Printing Mark outside window	POS_ZSW2.2 Ready to Accept new Setpoint	Velocity Limit Is Active	Tracking Mode Is Active
	N94:3	ZSW2	Sign-Of-Life				Device specific	Device specific	Device specific	ZSW2.8 Travel to Fixed Stop Is Active	Device specific	Device specific	Device specific	Device specific	Device specific	Device specific	Device specific	
	N94:4	MELDW	Reserved B15	Reserved B14	Pulses Enabled	Drive Ready	Controller Enable	Reserved B10	Reserved B9	Speed Setpoint - Actual Deviation Within tolerance	No alarm, thermal overload, power unit	No motor over-temperature alarm	Variable signaling function	Reserved B4	Setpoint(n) x speed threshold value 2	Setpoint(n) x speed threshold value 3	Torque[%] - torque threshold value 2	0 = Ramping Active 1 = Ramping Completed
	N94:5	XIST_A	Actual Position Value TAS P1.128															
	N94:6	XIST_A	Actual Velocity Value															
	N94:7	XIST_B	Active Fault Number															
	N94:8	XIST_B	Active Warning Number															
	N94:9	FAULT_CODE	Not Used															
	N94:10	WARN_CODE																
N94:11	Reserved																	

5.3.2 Modbus FC#16 Write Multiple Registers

Subroutine: MSG Rungs 4-6:

The MSG instruction uses the ModbusTCP channel to **WRITE OUTPUT DATA** from the PLC data table into the CMMT-XX-EP: N95:0 PLC OUTPUT DATA → CMMT-XX-EP

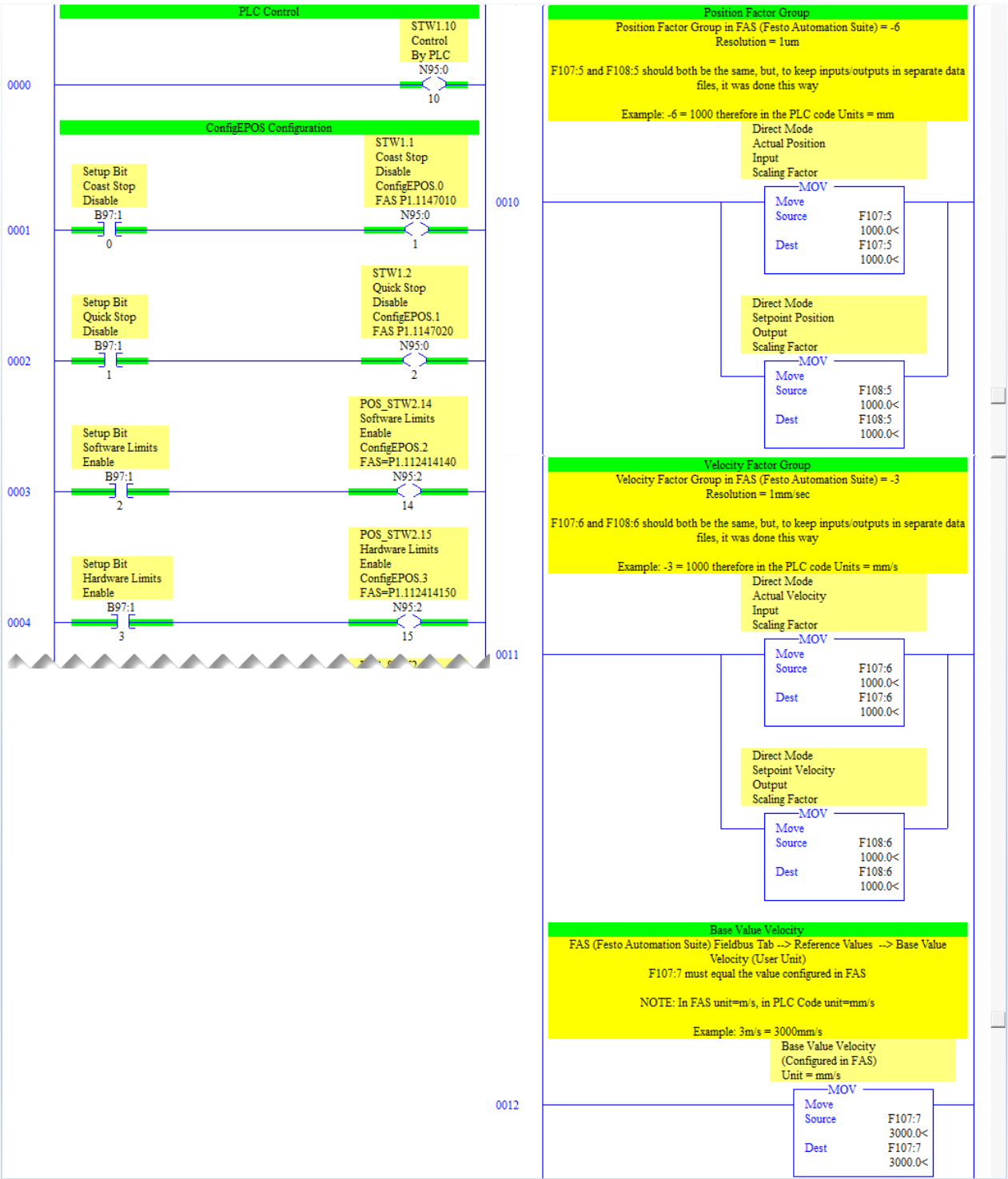


5.3.3 Configure and Setup

Subroutine: SETUP Rungs 1-12:

This routine provides code to configure and setup the drive and sometimes references Festo Automation Suite (FAS) configuration values that need to be match in the PLC (Programmable Logic Controller) code;

- PLC Control
- ConfigEPOS Configuration
- Position Factor Group (Be certain to match the Festo Automation Suite Fieldbus Factor Group setting)
- Velocity Factor Group (Be certain to match the Festo Automation Suite Fieldbus Factor Group setting)
- Base Value Velocity



5.3.4 Conversions

Subroutine: POS_FLTINT Rungs 1-3:

Subroutine: POS_INTFLT Rungs 1-4:

Subroutine: VEL_FLTINT Rungs 1-3:

Subroutine: VEL_INTFLT Rungs 1-3:

These routines all provide necessary conversion to/from data types used in the CMMT vs the PLC as follows:

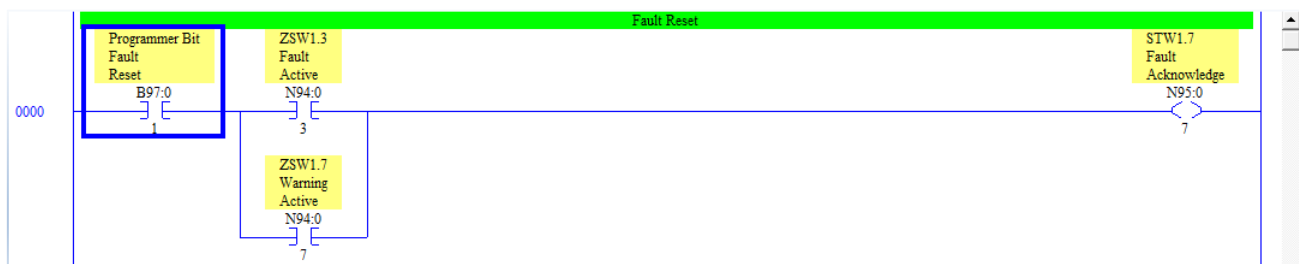
- POS_FLTINT --> Position Actual - Convert Float to 2 Integers
- POS_INTFLT --> Position Target - Convert 2 Integers to Float.
- VEL_FLTINT --> Velocity Actual - Convert Float to 2 Integers
- VEL_INTFLT --> Velocity Target - Convert 2 Integers to Float

5.3.5 Clear Faults

Subroutine: COMMON Rungs 0 and 12:

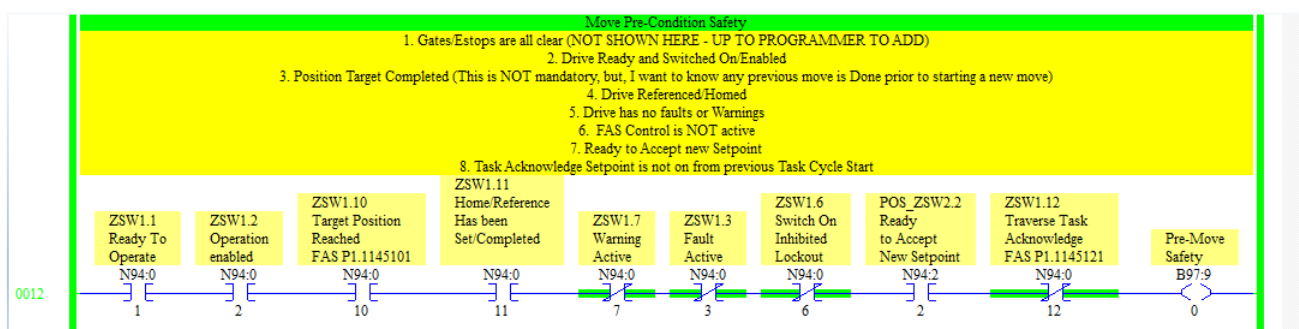
Step #1

Toggle B97:0/1 Programmer Bit Fault Reset **ON**



Step #2

Status bits for axis should resemble these for the Axis



5.3.6 Enable the Axis

Subroutine: COMMON

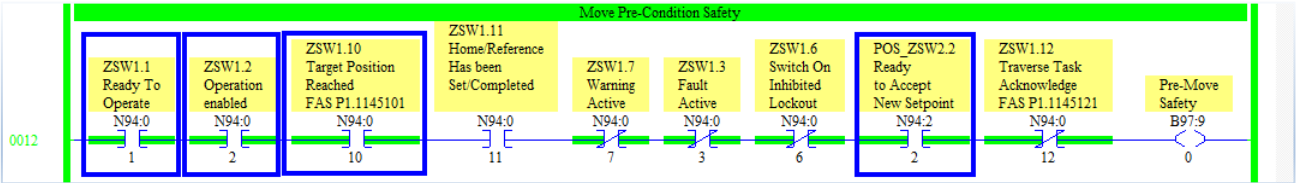
Step #1

Toggle B97:0/0 Programmer Bit Create Drive Ready ON



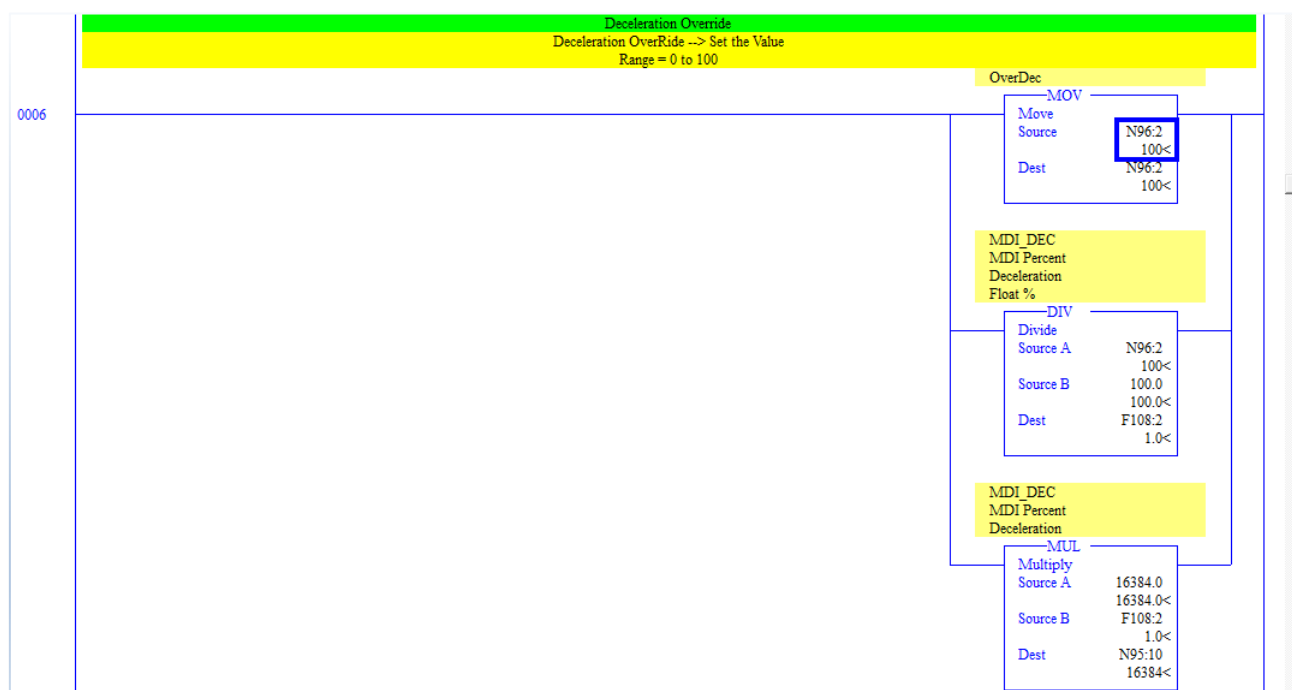
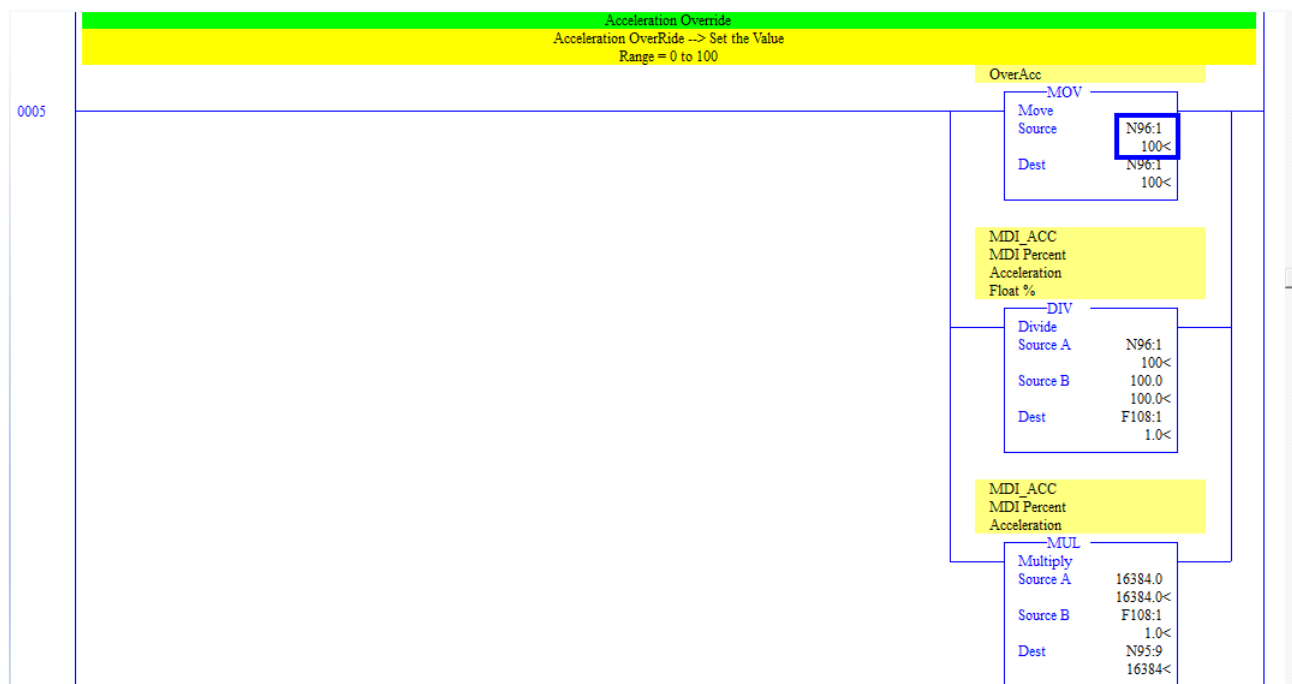
Step #2

Status bits for axis should resemble these for the Axis

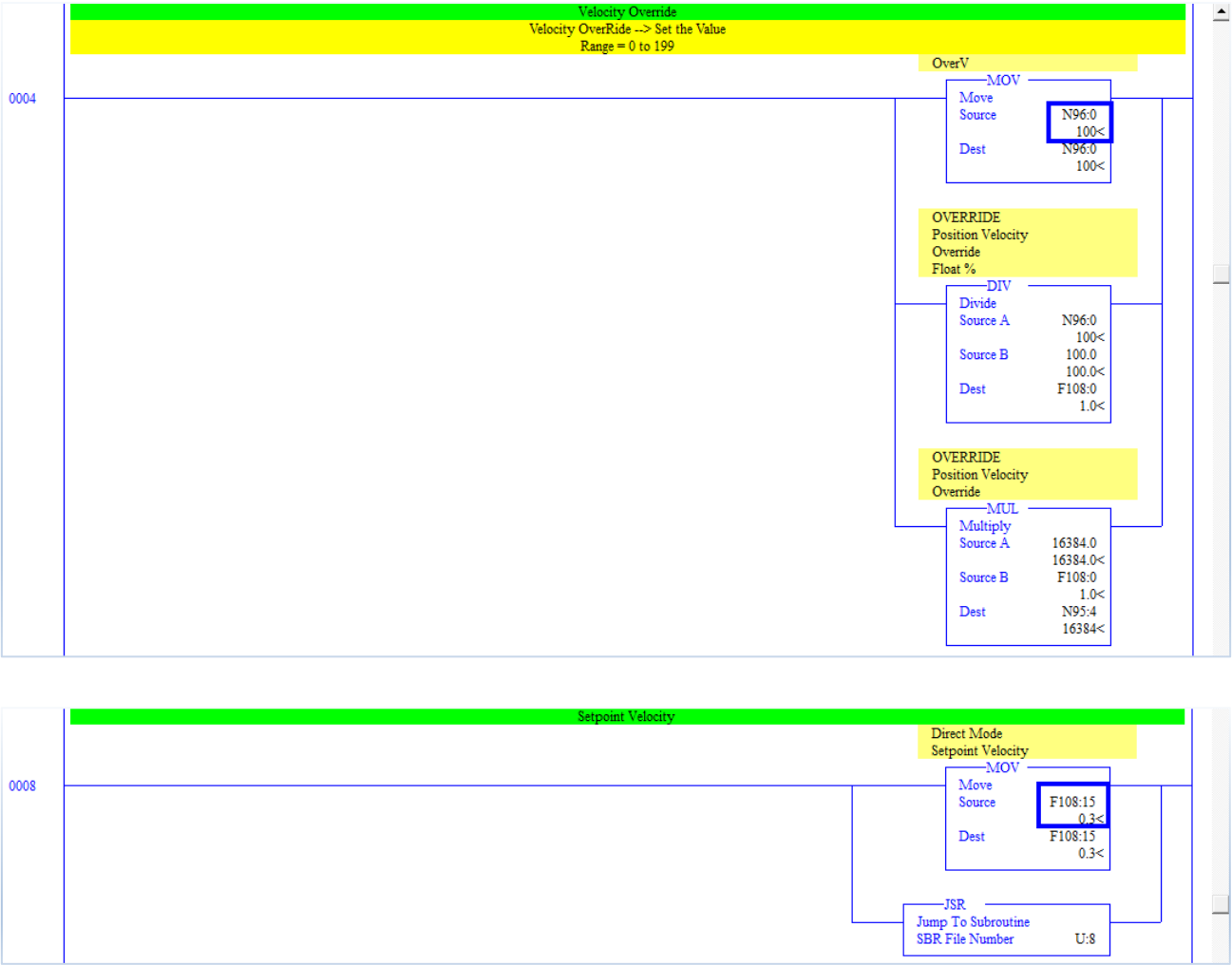


5.3.7 Set Acceleration and Deceleration

Subroutine: COMMON



5.3.8 Set the Velocity Override and Velocity
Subroutine: COMMON

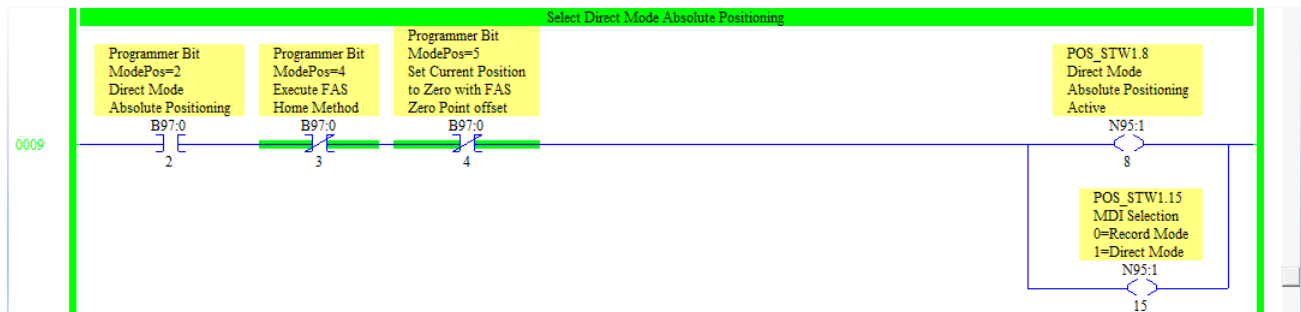


5.3.9 Home/Reference

Subroutine: COMMON

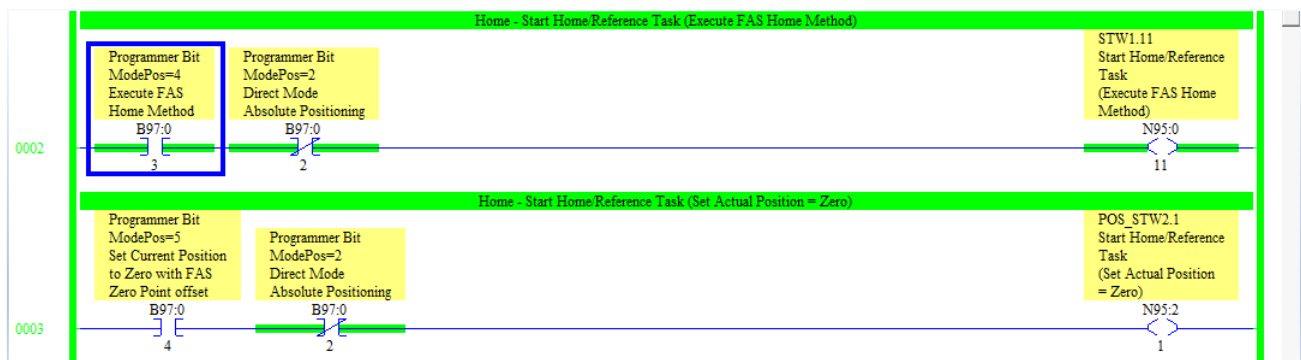
Step #1

Prior to reference/home of the axis, make certain both POS_STW1.8 Direct Mode Absolute Positioning Active and POS_ZSW1.15 MDI Selection are **OFF**



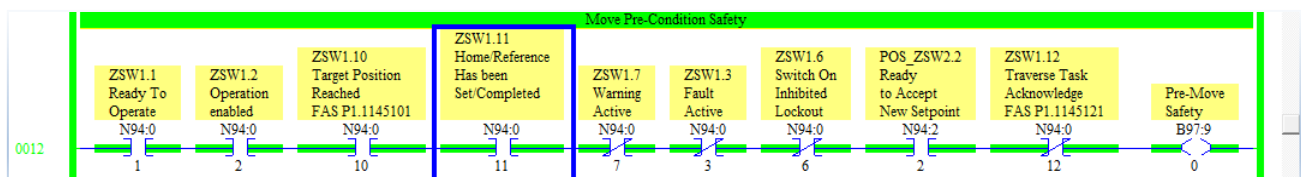
Step #2

Home the Axis using either "one" of the desired methods



Step #3

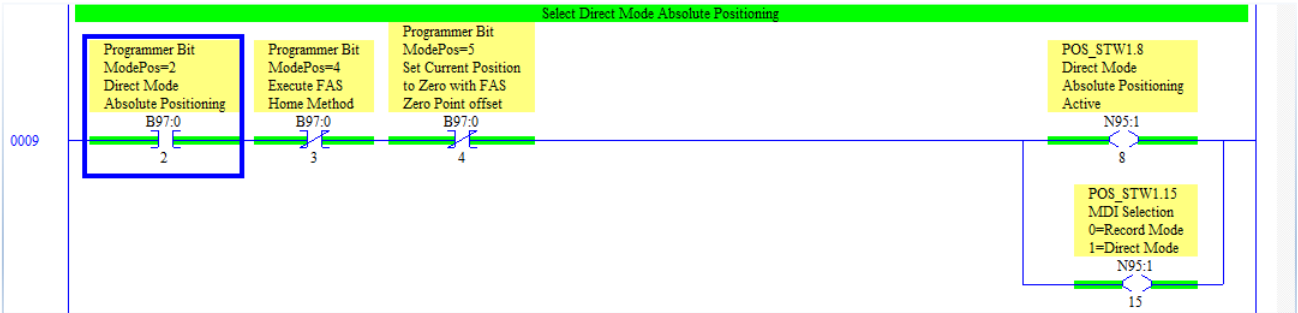
Status bits for axis should now have ZSW1.11 Home/Reference Has been Set/Completed turned **ON**



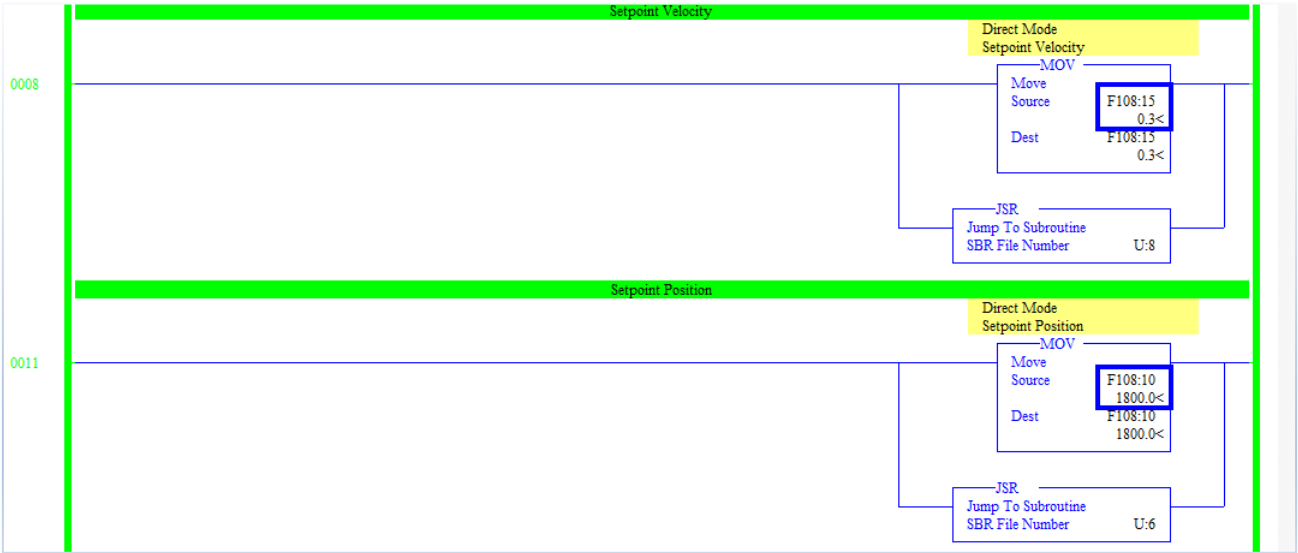
5.3.10 Point-to-Point (PtP) Move Single

Subroutine: COMMON

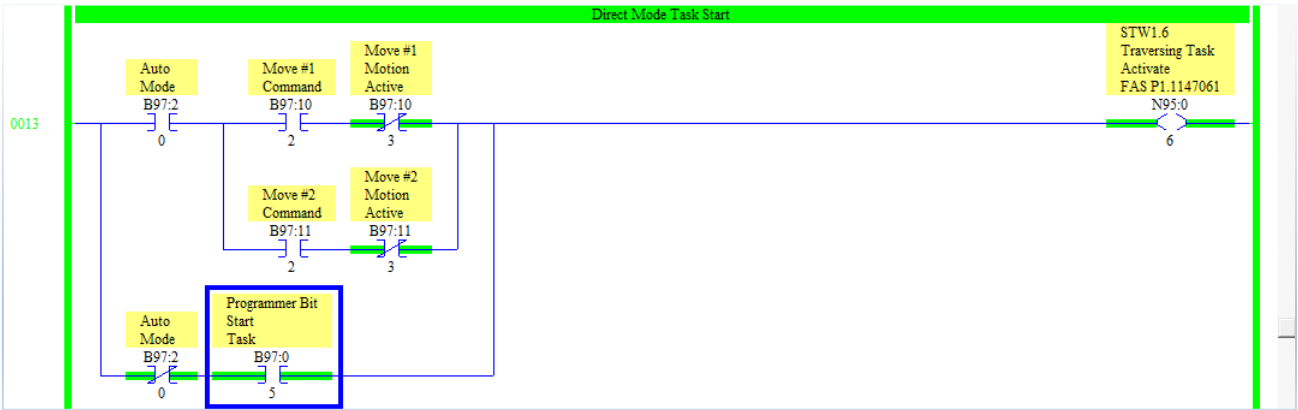
Step #1
Enable Direct mode for Point-to-Point (PtP) positioning



Step #2
Enter Setpoint Values for F108:15 (Velocity) and F108:10 (Position Target)



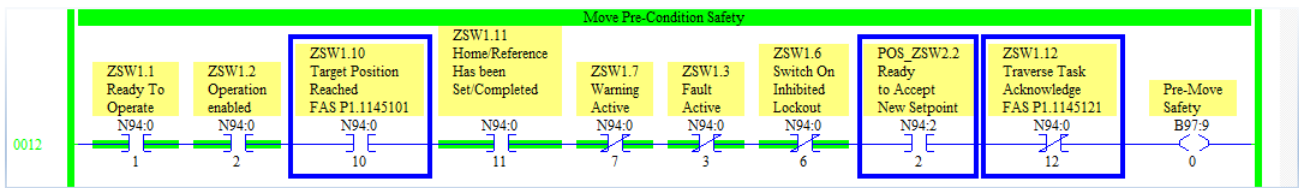
Step #3
Toggle B97:2/0 Auto Mode OFF and Toggle B97:0/5 Programmer Bit Start Task ON



Step #4

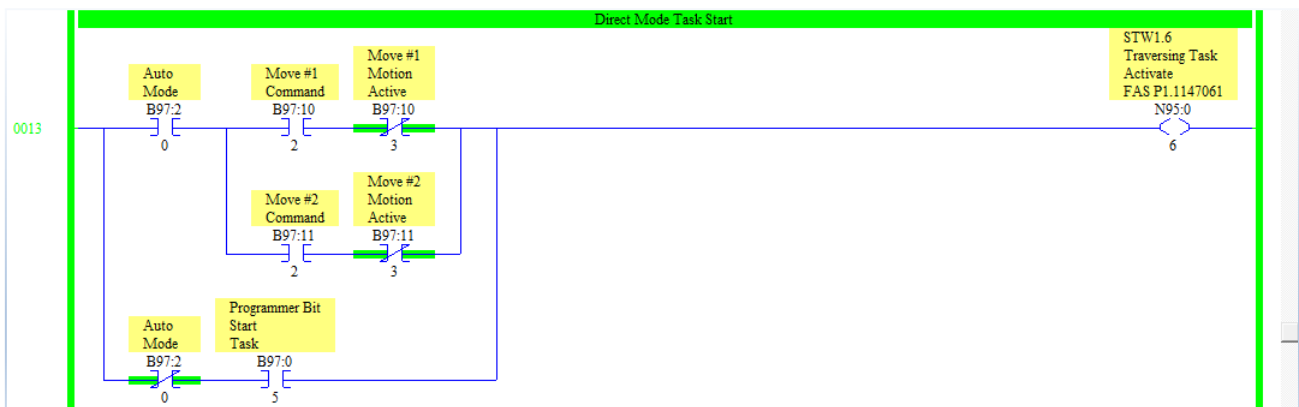
Wait for the status ZSW1.12 Traverse Task Acknowledge **ON** and

ZSW1.10 Target Position Reached and POS_ZSW2.2 Ready to Accept New Setpoint should to turn **OFF**



Step #5

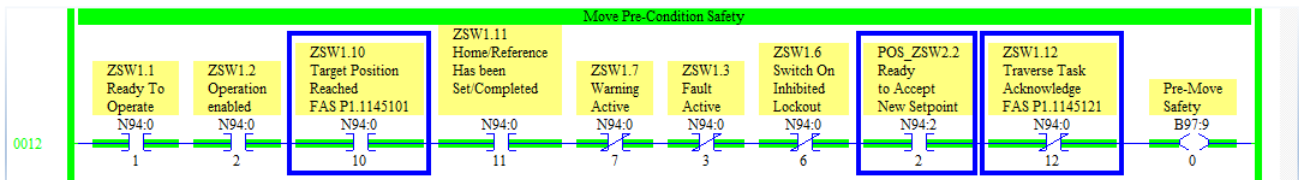
Toggle B97:0/5 Programmer Bit Start Task **OFF**



Step #6

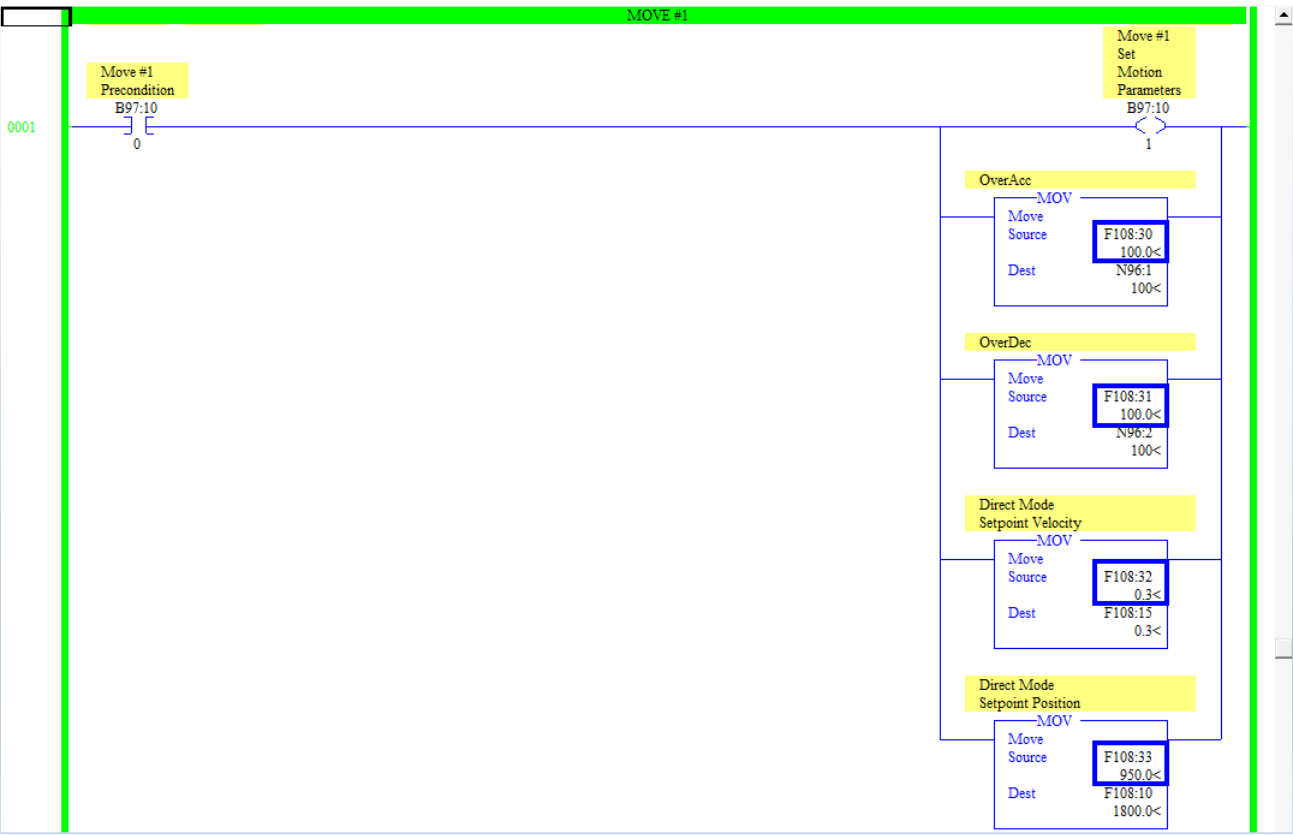
Wait for the status ZSW1.12 Traverse Task Acknowledge **OFF** and

ZSW1.10 Target Position Reached and POS_ZSW2.2 Ready to Accept New Setpoint should to turn **ON**

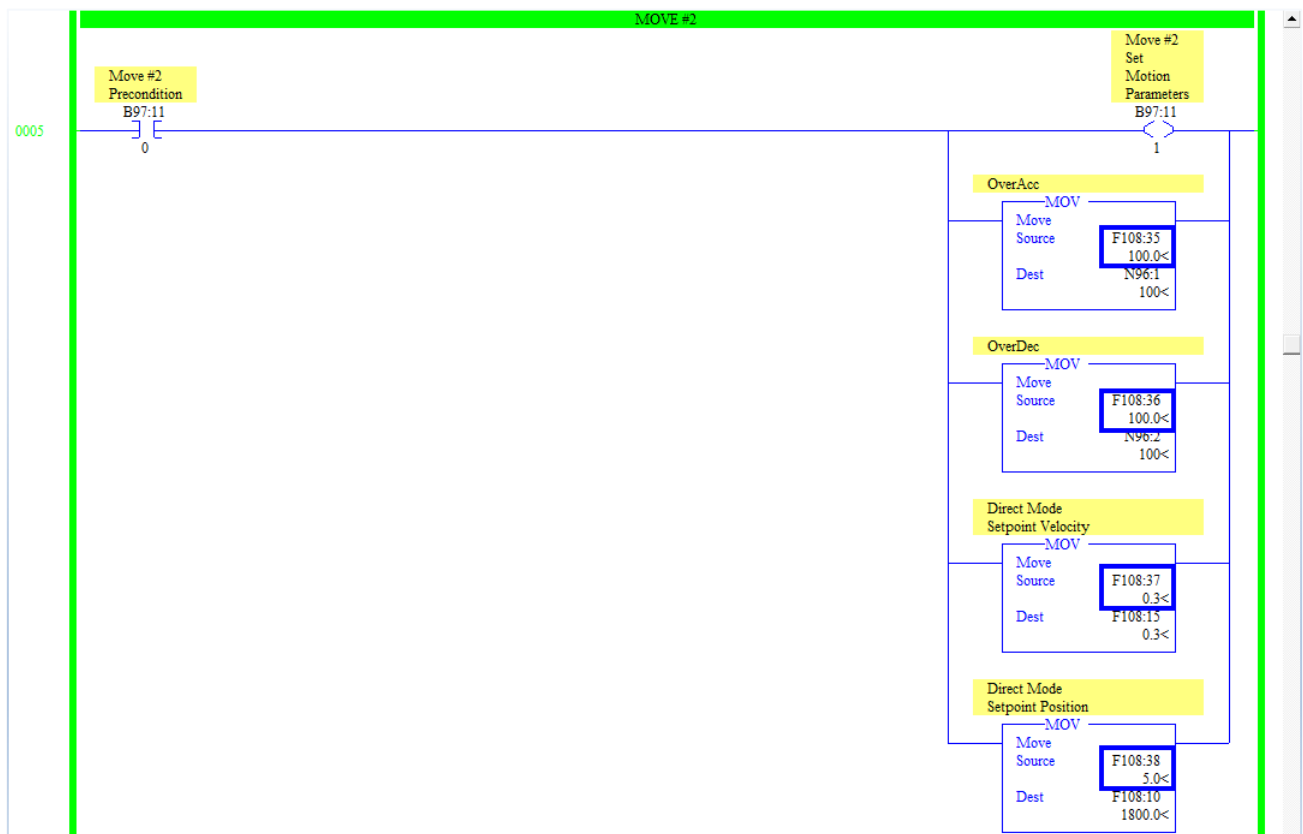


5.3.11 Point-to-Point (PtP) Move Sequence
Subroutine: MOVES

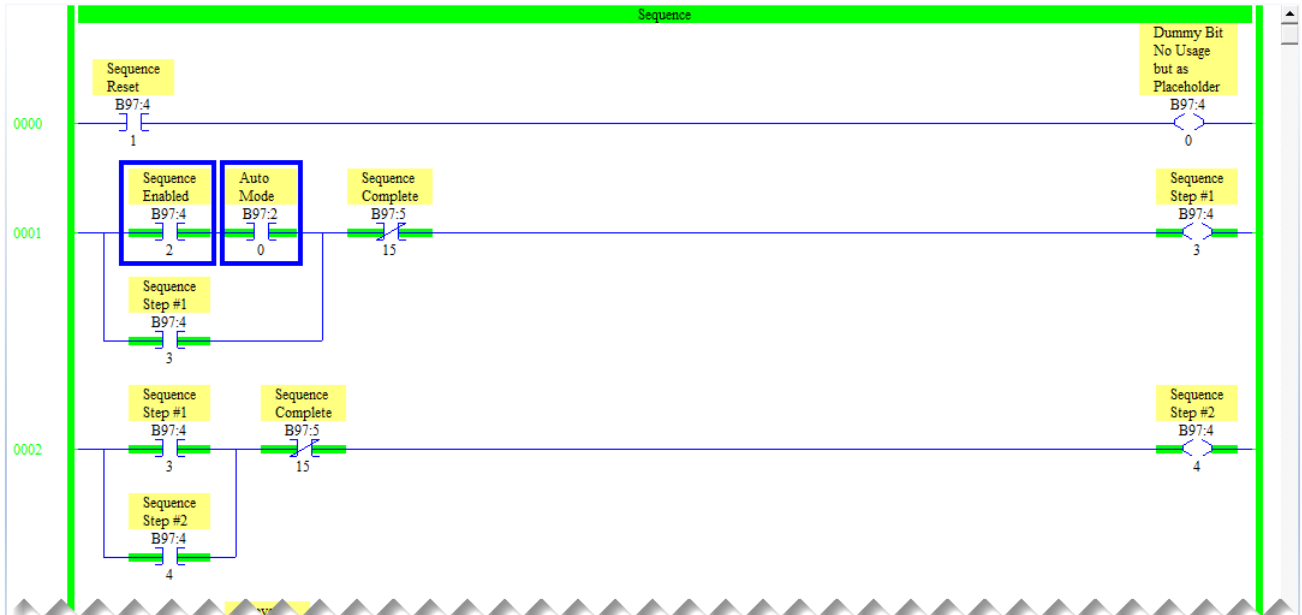
Step #1
Move #1 enter setpoint values for F108:30 (Acceleration), F108:31 (Deceleration), F108:32 (Velocity), and F108:33 (Position Target)



Step #2
Move #2 enter setpoint values for F108:35 (Acceleration), F108:36 (Deceleration), F108:37 (Velocity), and F108:38 (Position Target)



The sequence will continuously run Move #1 and Move #2 and then start over.



The sequence will stop after the last Move #2 is completed.

