Model 6 OMNI CENTER: FLEX Control Bus Option

Class 8998

Merlin Gerin
Modicon
Square D
Telemecanique
Schneider Electric Brands

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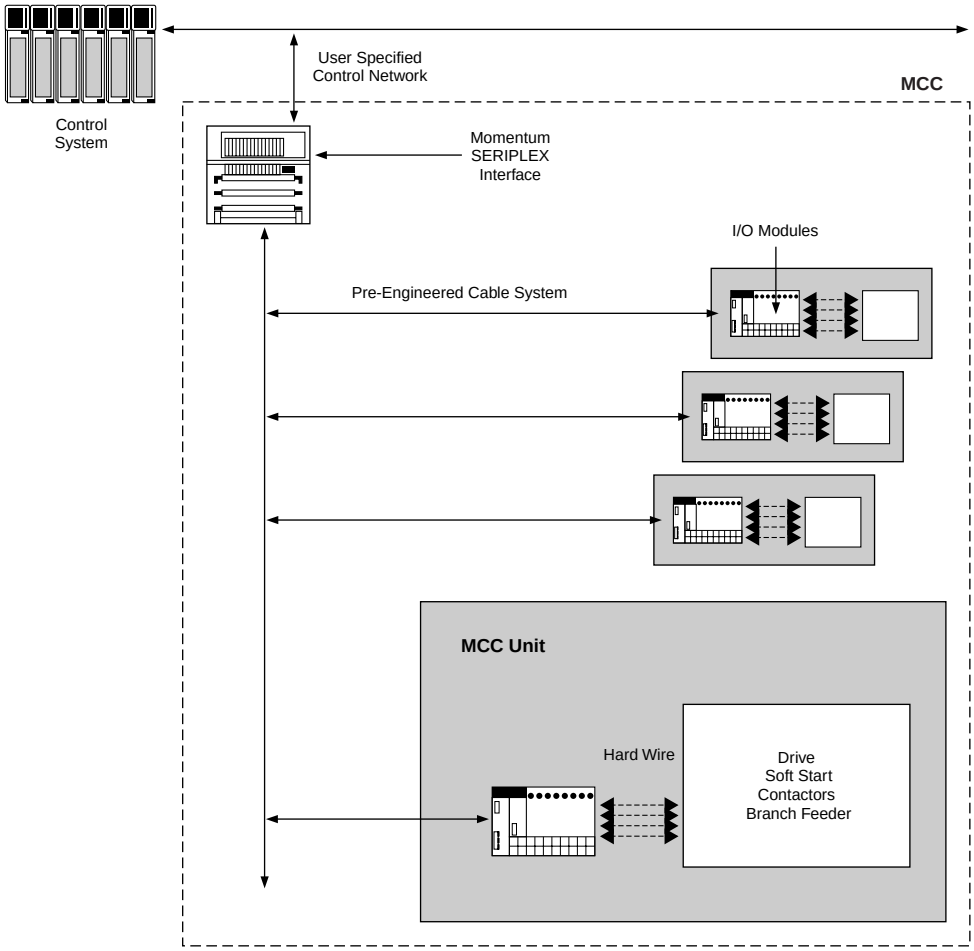
Product Family Overview

The Model 6 OMNI Center featuring the Flex control bus option provides a cost effective method of connecting digital control systems (PLC's, DCS's, environmental systems, etc.) to motor control center units. Installed cost savings of over 20% can be expected versus traditional field wired automation solutions.

The system utilizes SERIPLEX® Technology, which is simple, deterministic and allows connection to new or existing control systems via a variety of open network protocols. Usually an entire MCC can be configured as a single node on the preferred upstream network, dramatically reducing computational, software and network resource requirements.



System components include:

- **Discrete I/O Modules** located in each starter unit to control the starter coil and monitor user-defined inputs (contactor state, overload status, HOA position).
- **Pre-engineered cable and connector assemblies** replace bundles of hard wiring typically used to connect MCC units with external control systems.
- **Network interfaces** provide seamless connectivity to a variety of control systems including MODBUS® PLUS, DeviceNET™, PROFIBUS® and Ethernet.
- **Power Supply Units** supply I/O module power and control bus power for the entire MCC.

MCC Starter Unit
with SERIPLEX Discrete I/O Module
(Terminal Blocks Not Required)

System Features and Benefits

- MCC units are factory inter-wired via control bus and tested before shipment.
  - — Reduced startup and commissioning time
- Single five-conductor cable to connect all devices to control bus
  - — Lower installed cost, quicker setup, easy to maintain and modify
- Multi-network connectivity
  - — Includes networks such as MODBUS PLUS, Ethernet, DeviceNET and PROFIBUS
- Hand-held setup tool (optional)
  - — Quickly and easily sets or modifies the address of an I/O module without complex network management tools.
- Single network accommodates 240 inputs and 240 outputs
  - — Entire MCC can usually be represented as one network node
- Data timing is fast, exact and repeatable
  - — Control performance is predictable
- Control bus distributes module power and control signals
  - — Bus operation is independent of individual units

General I/O Module Features

- Pull-apart terminals
- 24 Vdc bus powered
- High noise immunity for industrial applications
- LED indicators provide power-on and input/output status.

Starter Unit Discrete I/O Module Features

- Standard module includes 2 inputs and 2 outputs (user defined: contactor state, O/L state, contactor coil control, HOA)
- Expandable up to a total of 4 inputs and 4 outputs (contactor 2 state, contactor 2 coil control, user defined)

Main and Branch Unit Discrete I/O Module Features

- Supports hard contact connections without additional control power
- 2 inputs for disconnect state and trip indication

Drives Interface Module Options

- Utilize discrete I/O modules and multiple preset speed capability of drive.
- Utilize discrete I/O modules and increase / decrease functionality of drive.
- Special purpose interface module available featuring 3 inputs, 2 outputs and 1 analog output for speed reference

Interface Devices

The primary network interface module used is the Momentum SERIPLEX interface base unit 170ANM05010. The Momentum SERIPLEX interface base unit uses 32 input and 32 output registers. (See the Momentum 170ANM05010 instruction bulletin for details). Network communication adapters are used to create a gateway between the SERIPLEX control bus and higher-level communications networks including:

- MODBUS PLUS 984
- MODBUS PLUS IEC
- Redundant MODBUS PLUS
- Ethernet
- DeviceNET
- PROFIBUS
- INTERBUS-S®

Control Bus Cabling (Side View)

Cabling System

A UL CM/Class 2 600V listed cabling system is used to interconnect units within the MCC. The cabling system is constructed of molded PVC material using five 22 AWG conductors:

Two (2) conductors used for power (Red: V+, Black: Common)
Two (2) conductors used for signal (White: Data, Blue: Clock)
One (1) conductor used for shield (Bare)

The cabling system consists of individual trunk line segments in each MCC section. A trunk/tap topology is used. The trunk line segments are routed from the lower wire-way into each vertical section. Each trunk section measures 194 inches (approx. 16 feet) in length and consists of six molded-in tap connectors, evenly spaced at 12-inch intervals followed by 120 inches (10 feet) of cable. The additional cable is used to return to the lower wireway and connect to the next section. Unused tee connectors are capped at the factory.

A 36 inch (3 foot) “pigtail” cable connects the tap in the trunk cable to the SERIPLEX module in each MCC unit. One end of the pigtail cable terminates in a Micro-style connector and is attached to the trunk. The other end terminates at the SERIPLEX module in the MCC unit.

The assemblies utilize 5-pole Micro-style connectors with a single keyway. The epoxy-coated connectors are designed to SAE-H1738-2 specifications and pass 500-hour salt-spray test per Mil-Std 202F. The coupler design includes a vibration-resistant ratchet to prevent loosening. An extended ground pin ensures first make/last break ground connection.

In addition, removal or rearrangement of units does not disrupt the trunk line and does not affect the cabling of other units attached to the trunk line.

Effective isolation between the SERIPLEX network cabling and high voltage/current cabling in the MCC is accomplished by taking advantage of the industry-leading full-depth wire-way of the Model 6 MCC. The SERIPLEX trunk is secured to the wire-way channel. Load cabling should be located at least 3" from the communication cable.

With the inherent noise immunity of the SERIPLEX Control Bus and with proper load cable installation, the system produces a very robust installation.

Power Supply Units

The standard SERIPLEX power supply unit occupies 6 inches of space and includes a GJL circuit breaker disconnect, a 150 VA control power transformer, a 24 Vdc supply rated at 2.4 A, and appropriate fusing. At least one power supply unit is required for a SERIPLEX control bus. This power supply may be external to the MCC but Square D recommends use of the standard MCC power supply unit.

In general, a single power supply will accommodate up to 32 motor starters or 8 vertical MCC sections (whichever comes first). Power supply sizing is based upon individual applications and is usually limited by total capacitance, not by ampacity. Refer to the application and general information section of this publication for additional information.

Configuration

Model 6 OMNI Centers with FLEX Control Bus are available pre-configured from the factory and will not normally require reconfiguration unless changes or additions are made.

Configuration of the SERIPLEX control bus network is simple and straightforward. Each I/O module requires a unique address for proper communication.

Addresses are formatted as a three-digit identifier, valued between 1 and 255. Address 0 is reserved by the SERIPLEX system. The address is programmed in the SERIPLEX chip (inside the I/O module) with an SPXSST2 hand-held configuration tool, where it remains until reprogrammed, even if power is removed.

The addressing scheme may be preset at the factory according to either standard designations or to specifications supplied by the customer. Factory addressing starts at 16, unless otherwise specified.

Network interface configuration is dependent on the network selected. Refer to the Momentum SERIPLEX Interface 170ANM05010 Instruction Bulletin for details. In general, once the interface is configured, changes and modification to the MCC will not require interface reconfiguration.

Power Supply Unit Selection Information

The following table can be used to calculate appropriate bus power supply size. If the total power requirements for the SERIPLEX segment exceeds 2.4 A, the system must be separated into multiple networks with independent power supplies.

Normally segment capacitance, not power consumption, is the limiting factor on segment size. The SERIPLEX Netck_3.xls (Excel Spreadsheet) software or the graphical SERIPLEX toolbox can be used to verify I/O count, capacitance and power consumption at the same time.

Component Description	Application	Ampacity Requirements	
		SERIPLEX Bus	External
I/O module, 2 input, hard contact	Mains and branches	20 mA at 30 Vdc	30 mA at 132 Vac
I/O module, 2 input	Starters, drives and soft starts	20 mA at 30 Vdc	30 mA at 132 Vac
I/O module, 2 output		20 mA at 30 Vdc	4 A (AC or DC)
I/O module, 2 input/2 output		20 mA at 30 Vdc	4 A (AC or DC)
ALTIVAR® 66 drive module	Drives	40 mA at 24 Vdc	365 mA at 24 Vdc
TSX Quantum PLC module	PLC interface	100 mA at 24 Vdc	50 mA at 5 Vdc
Momentum SERIPLEX Interface	Network Interface	100 mA at 24 Vdc	300 mA at 24 Vdc

Capacity

The capacity of a given network segment is limited by the I/O count, the total current demand and the capacitance of the system. In general, a single segment with a 2.4 amp power supply will accommodate up to 32 motor starters or 8 vertical MCC sections (whichever comes first).

Although the maximum size for a single SERIPLEX control bus is a total of 255 addresses, a typical network only utilizes 240 inputs and 240 outputs for a total of 480 I/O. The first 16 addresses are usually reserved for the bus master.

Several segments can be combined into a single network by breaking the power conductor between segments (and power supplies). This is accomplished using a special molded connector that is included with MCC configurations that require multiple power supplies. By combining segments, up to 120 units can be represented as a single node by the network interface.

Using MODBUS PLUS and Quantum PLC's, 31 slave nodes can be supported on a single network. In this configuration up to 3720 units can be networked to a single communication port. Some processors will support up to three MODBUS PLUS ports providing up to 11,160 units on a single processor! In general the practical limit is usually about 1,800 units on low-end processors with a single port and 5,000 units on high-end processors.

The SERIPLEX Netck_3.xls (Excel Spreadsheet) software or the graphical SERIPLEX Toolbox should be used to verify I/O, capacitance and power consumption requirements.

Troubleshooting

The SERIPLEX control bus network is as simple to diagnose as it is to install. Diagnosis can usually be accomplished with just the hand held set-up tool and a voltmeter. Four basic areas to consider when troubleshooting a SERIPLEX control bus in Model 6 MCCs:

- Bus power supplies
- Interface or clock source hardware
- Bus cabling and grounding
- I/O devices

The SERIPLEX Set-up Tool (SPXSST2) is a portable device used to enter and read configuration data for the SERIPLEX I/O modules. This tool requires an external power supply (part number SPXSSTACADPT) or 4 AA batteries and communication cable (part number SPXHH2Y2CABLE). Power supply, batteries and cable are included with the purchase of the Set-up Tool.

Refer to SERIPLEX Design, Installation, and Troubleshooting Manual (Bulletin 30298-035-01) for detailed information regarding the complete diagnosis of SERIPLEX applications. SERIPLEX Netck_3.xls (Excel Spreadsheet) software is included with this manual. In addition a SERIPLEX Toolbox (with Windows based Graphical Interface) may be freely downloaded at the following SERIPLEX website address: www.seriplex.org/part3/squared8.html

Voltages

Model 6 Motor Control Centers incorporating SERIPLEX control bus products are compatible with all current system voltages and distribution types, including 600 V. Control power is restricted to 120 Vac for the control components. Line voltage control is not supported. Control power options include individual unit CPTs, or separate source. Central controllers, bridges and interfaces, as required, also include provisions for CPT or separate source control power distribution schemes.

Ratings

Model 6 Motor Control Centers incorporating SERIPLEX control bus products do not affect existing short-circuit ratings of Model 6 MCCs. Refer to Model 6 Catalog 8998CT9701 for this information.

Environmental ratings are as follows:

- External ambient air temperature F/0-40°C
- Altitude: 1000 m/3300 ft maximum.

References

- Model 6 MCC Catalog 8998CT9701R12/97
- Model 6 MCC Instruction Bulletin, Order No. 80459-641-01A
- SERIPLEX Control Bus, Version 2 Catalog 8330CT9601R3/97
- SERIPLEX Design, Installation, and Troubleshooting Manual, Order No. 30298-035-01
- SERIPLEX Technology Organization, Products and Services Directory
- SERIPLEX Toolbox, downloadable from www.seriplex.org/part3/squared8.html
- Momentum SERIPLEX Interface Base Unit, 170ANM05010. Instruction Bulletin Order No. 30298-073-01

For detailed information regarding SERIPLEX control bus visit the SERIPLEX Technology Organization Home Page http://www.seriplex.org.

Codes and Standards

UL 845 (July 1993)
UL 508 (September 1994)
NEMA ICS 3 (1993)
CSA C22.2 No. 14 (January 1992)
NOM J353 (1979), J290 (1982), J1118 (1978)
NEC (1996)
IEEE 519 (1992)

TYPICAL SPECIFICATIONS

General

A. The MCC shall be provided with a factory wired and tested I/O system. I/O modules shall be located in each unit of the MCC and connected via a dedicated cabling system to a single network interface located in a separate MCC compartment. This network interface links the I/O in the MCC to the specified control network (see Control Network Adapter Requirements section). Multiple control networks shall be supported via interchangeable communication adapters that may be field converted.

B. Communications within the MCC shall be at 24 Vdc to facilitate noise resistant operation. I/O modules shall operate from 24-volt power derived via a dedicated I/O power bus. Unless otherwise indicated, I/O will be 120 Vac for contactor coil control. Coil control power shall be provided by individual unit control power transformers.

C. The I/O system shall feature pull-apart connectors, allowing the removal of the I/O modules without disturbing the wiring. LED's shall be provided to indicate module and I/O status.

D. The MCC shall be Square D Model 6 OMNI Center or approved equivalent.

Starters

A. Starters shall have a minimum of 2 inputs and 2 outputs available for user defined functionality. Expansion capability of up to a total of 4 inputs and 4 outputs shall also be available. I/O modules are common and shall be independent of starter or overload type. Reversing, soft starters, two-speed, and autotransformer starter applications shall include 4 inputs and 4 outputs to adequately monitor all available inputs. Starter I/O modules shall be Square D model #SPX2A2A2AV2 or approved equivalent.

B. Unless otherwise indicated an input for overload, HOA position and control power status shall be provided (AUTO / READY).

C. Unless otherwise indicated an input for contactor state shall be provided (CLOSED=ON / OPEN=OFF). Indication of contactor mechanical state is required for testing without connected loads and for detection of mechanically forced contactors. Current sensing switches are not acceptable.

D. Transient suppressors shall be supplied for all coils in each individual starter unit. NEMA size 3 or larger starters require an interposing relay to electrically isolate the starter coil from the output.

E. *[Optional]* Starters shall include solid state overloads. Overloads shall be ambient insensitive and provide phase loss and unbalance protection. Trip adjustment shall be via a rotary dial with a tamper guard. Overloads shall be Square D Motor Logic or approved equivalent.

F. Starter units shall employ [*fusible switches / thermal magnetic circuit breakers*] for short circuit protection.

Mains & Branches

A. The interface for incoming main & branch feeder units shall be a bus-powered module and shall not require a voltage differential at the input or an additional power supply to operate. The module shall be capable of monitoring two inputs and is intended to provide branch status (ON / OFF). [Circuit breaker units will also include (TRIPPED / NO TRIP) indication].

B. The I/O modules shall be Square D part number SPX2DS0V2 or approved equal.

Drives

A. Drives shall have a minimum of 2 inputs and 2 outputs available for user defined functionality. Expansion capability of up to a total of 4 inputs and 4 outputs shall also be available. Drive I/O modules shall be Square D model #SPX2A2A2AV2 or approved equivalent.

B. Unless otherwise indicated two inputs for drive status shall be provided (IN AUTO/ READY) and (RUNNING). Unless otherwise indicated ONE output shall be provided (RUN / STOP). With expansion to 4 outputs, two additional preset speeds may be obtained or speed may be changed with (INCREASE SPEED / DECREASE SPEED) commands.

C. *[Optional]* An analog drive interface module shall be provided. The module shall provide as a minimum:

   1. Two (2) discrete outputs
   2. Two (2) discrete inputs
   3. One (1) analog output. This analog output shall provide speed control capability by a 0-10V analog output written as a 12-bit word with 10-bit resolution.

Power Supplies

A. I/O power shall be provided by an external 24 Vdc power supply.

B. *[Optional Preferred]* An MCC mounted power supply shall be provided in a 6" MCC unit containing a molded case disconnect switch or circuit breaker, a 150 VA control power transformer, primary & secondary fusing, and a 2.4 A DC power supply matched to the typical MCC network requirement.

Cabling System

A. A UL CM/Class 2 **600 V** listed cabling system shall be used to interconnect units within the MCC. The cabling system shall be constructed of molded PVC material using a five-conductor cable, each interior wire size shall not exceed 22 AWG and consisting of the following:

   1. Two (2) conductors used for power (Red: V+, Black: Common)
   2. Two (2) conductors used for signal (White: Data, Blue: Clock)
   3. One (1) conductor used for shield (Bare)

B. Cable system connectors shall meet the following minimum requirements:

   1. Standard 5-pole DC micro-style connections with a single key way
   2. Meet or exceed the current SAE-H1738-2 specifications
   3. Provide epoxy-coated coupler that passes 500-hour salt-spray test per Mil-Std 202F
   4. Provide vibration-resistant ratchet coupler design to prevent loosening
   5. Provide extended ground pin to ensure first make/last break ground connection.

C. The cabling system shall consist of individual trunk line segments routed through each MCC section. Each segment shall include six molded tap connectors, evenly spaced at 12-inch intervals. Unused taps shall be capped at the factory.

D. A short "pigtail" cable shall connect the taps in the trunk line to the I/O device in each MCC unit. One end of the pigtail cable terminates in a micro-style connector and is attached to the trunk line tap. The other end of the cable terminates at the I/O device in the MCC unit.

E. Addition, removal or rearrangement of units shall not disrupt the trunk line and should not affect the cabling of other units attached to the trunk line.

Control Network Adapter Requirements

A. The control network adapter unit shall consist of the MCC cable system host and interchangeable communication adapters. The system should be designed for minimum upstream software, hardware and network bandwidth requirements.

B. The cable system host shall perform all functions necessary to host the MCC cabling system and convert the data to a single distributed I/O node on the specified control network. The maximum node size shall be 32 input words and 32 output words. Field interchangeable communication adapters shall be available for the network specified and for other common control networks specifically including the following:

   1. MODBUS PLUS
   2. MODBUS
   3. Ethernet
   4. DeviceNET
   5. PROFIBUS

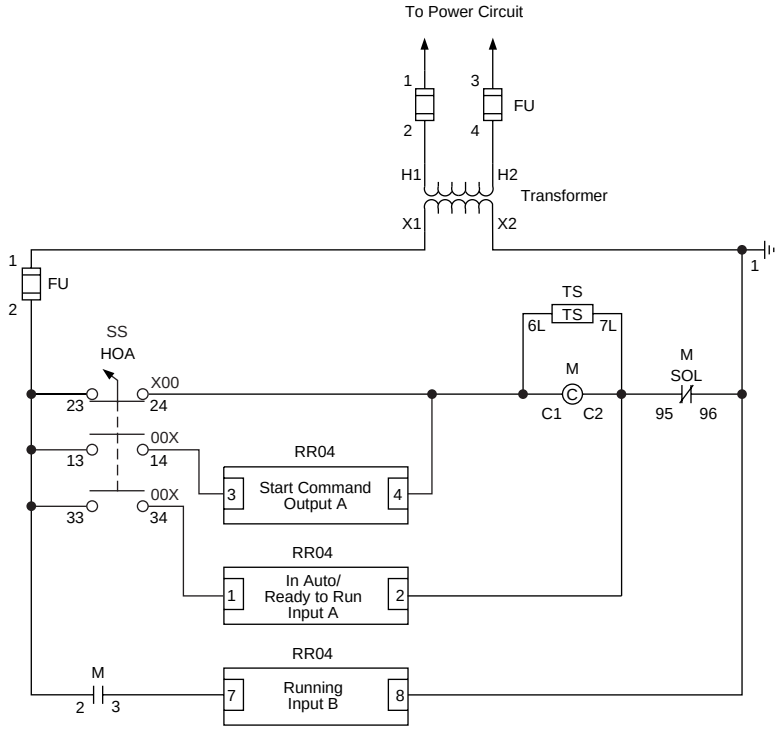
C. An optional processor adapter shall also be available as specified. The processor shall be capable of functioning as a complete PLC control system and provide for ladder and IEC 1131 programming languages. Higher level communications to upstream control systems shall be available via Ethernet, MODBUS or MODBUS +. An optional real time clock option with battery backup must be provided if specified.

D. The MCC cable system host shall be Modicon #170ANM05010 or equivalent.

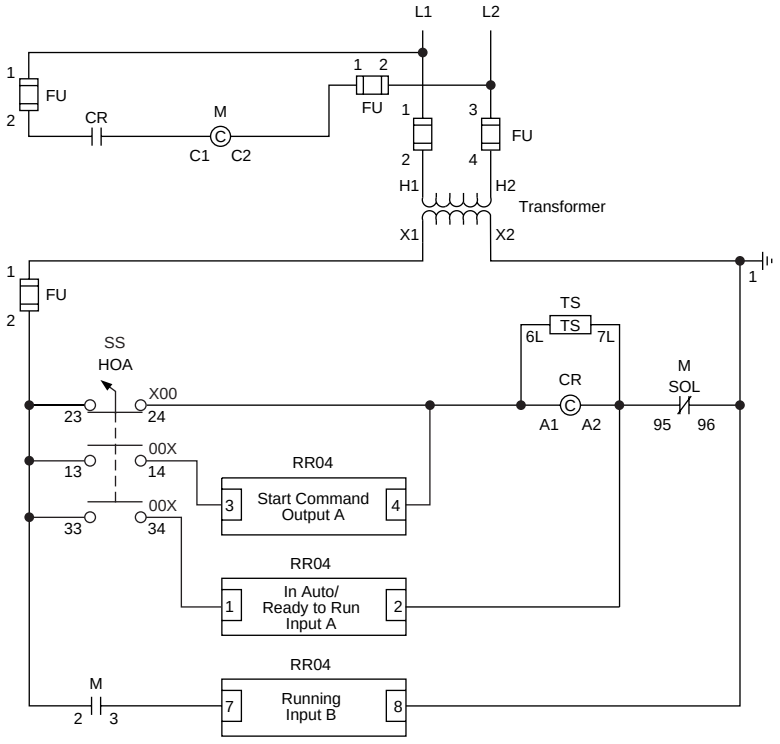
Testing

A. All system components shall be factory-wired and tested as a system prior to shipment. Testing shall be designed to verify system operation and shall include as a minimum:

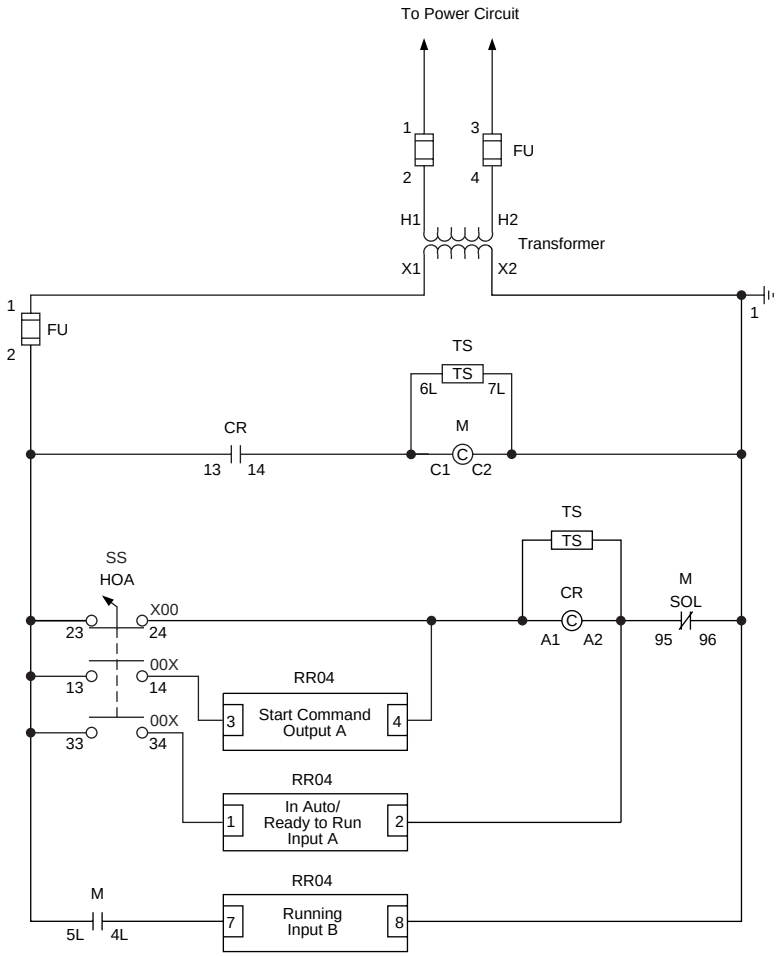
   1. Verification of drawings and bill of materials
   2. Verification of I/O addressing
   3. Verification of correct device operation by I/O address
   4. Verification of host communications



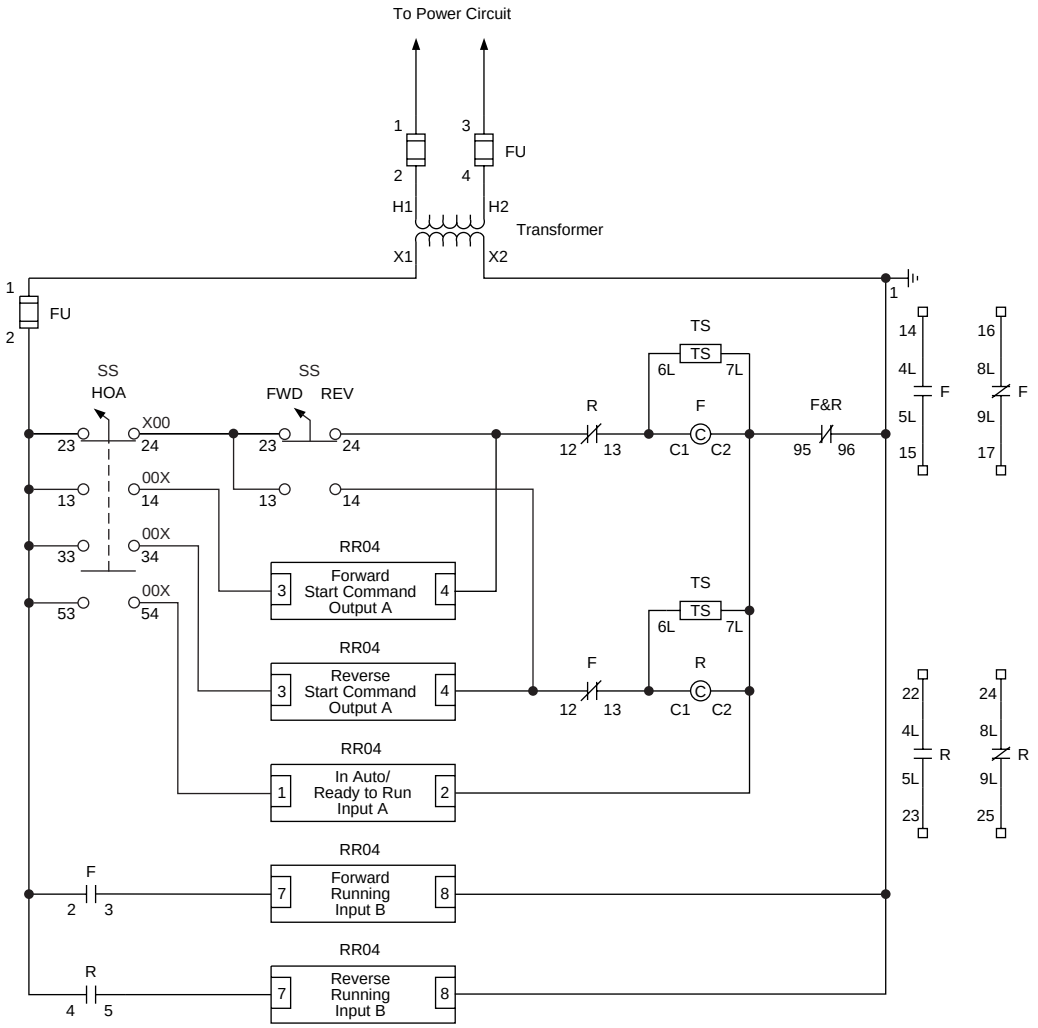
Sizes 1 and 2
Full Voltage Non-Reversing Starter Unit
Typical Schematic



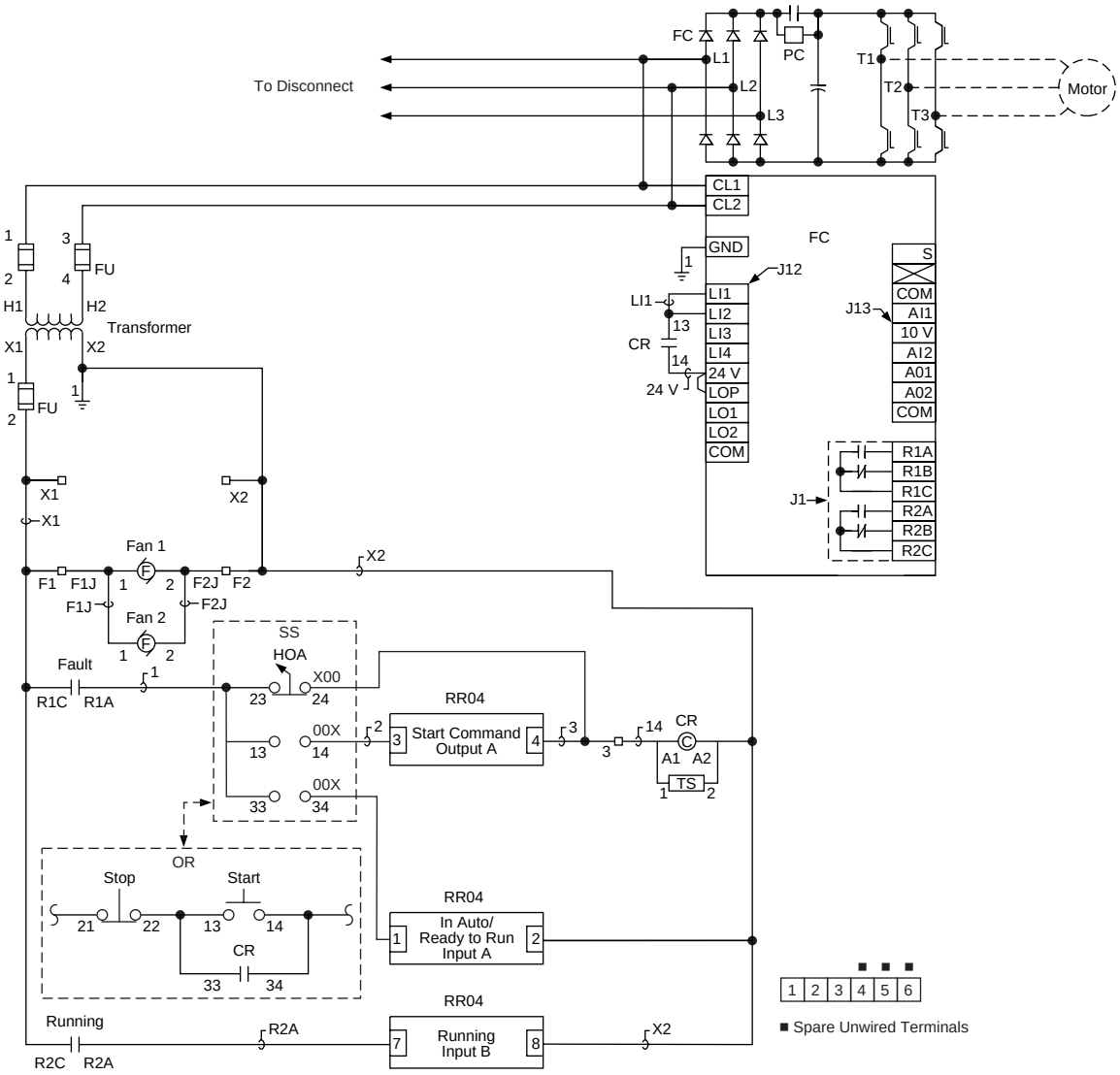
Size 5
Full Voltage Non-Reversing
Typical Schematic



Sizes 3, 4 and 6
Full Voltage Non-Reversing Starter Unit
Typical Schematic

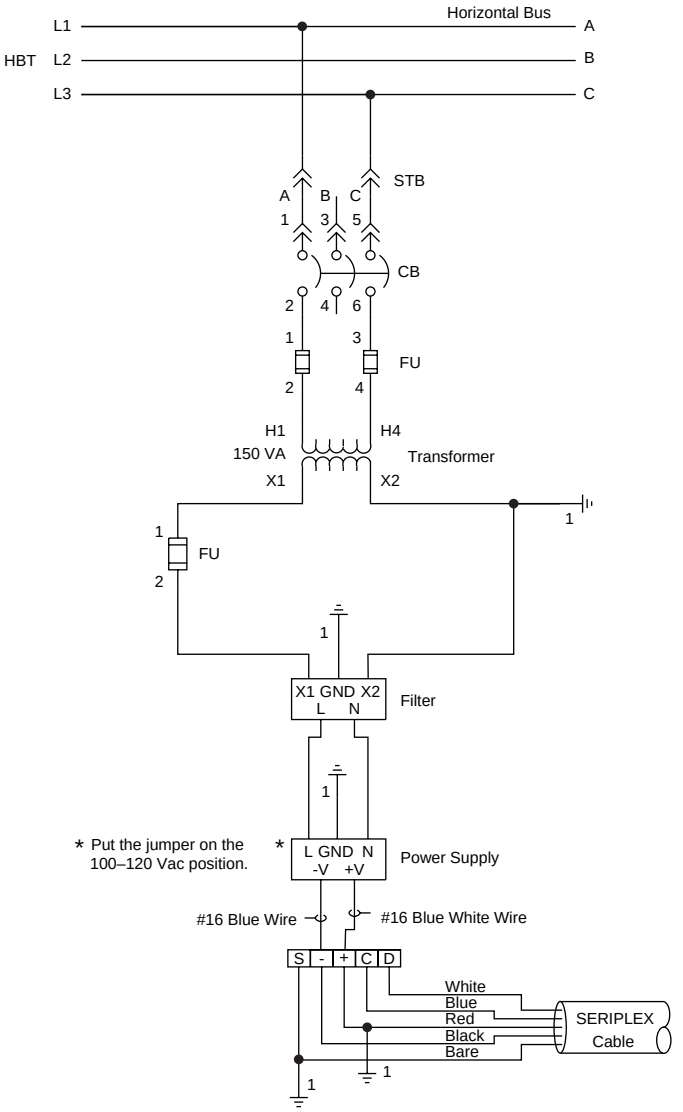


Sizes 1 and 2
Full Voltage Reversing Starter Unit
Typical Schematic
(Other Sizes Require Interposing Relays)

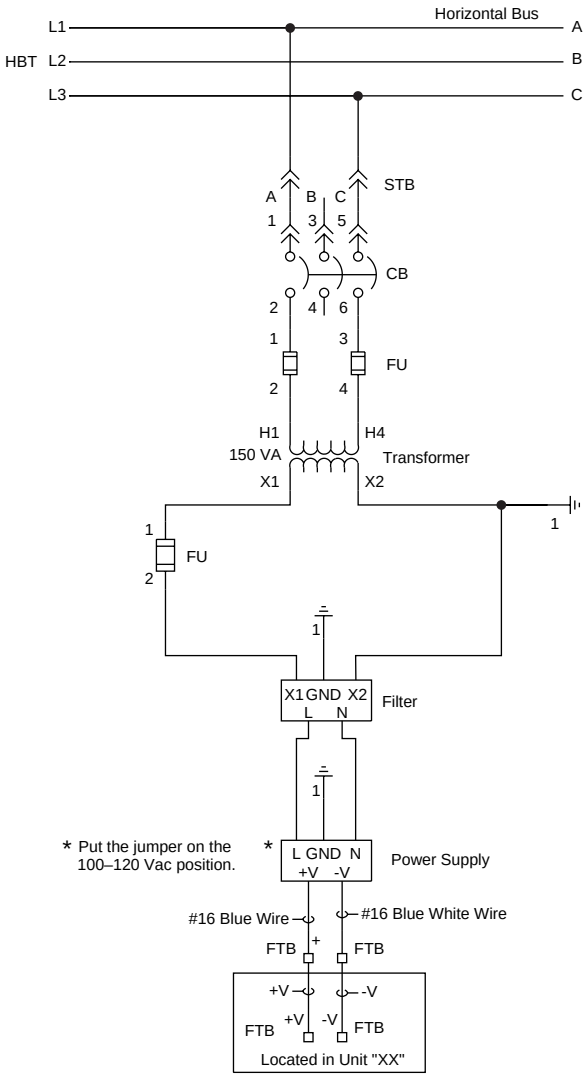


Variable Frequency Drive
Typical Schematic

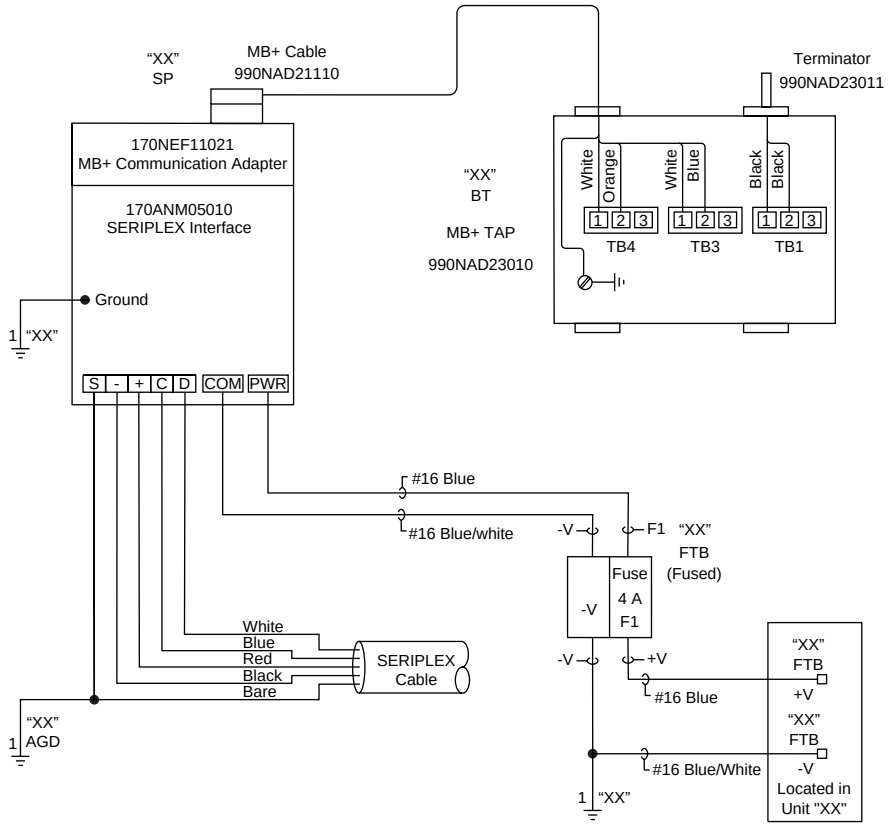
Wiring Diagrams



SERIPLEX Control Bus 24 Vdc
Power Supply Typical Schematic

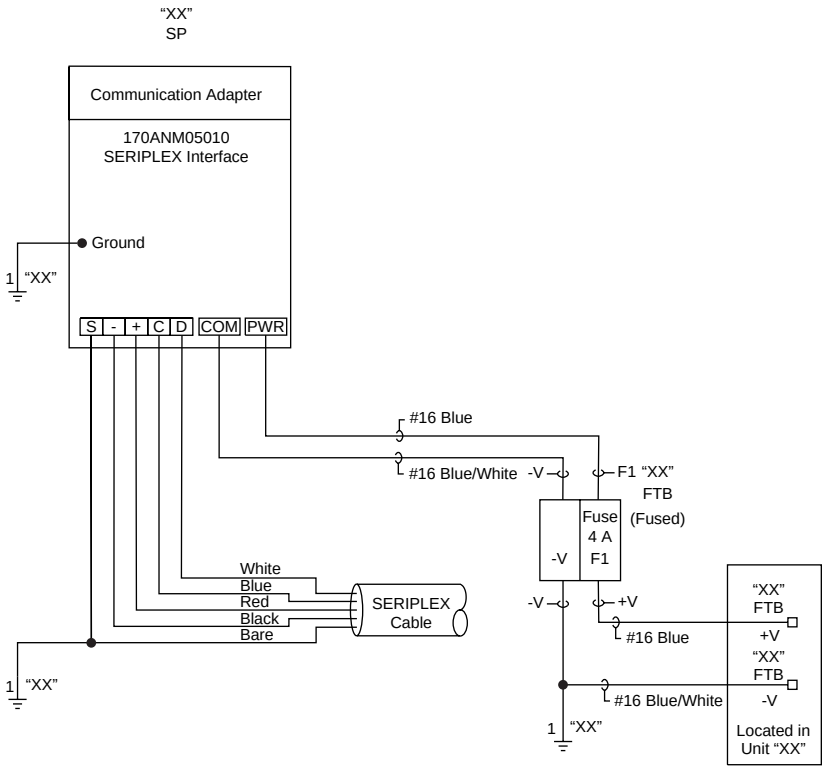


Momentum I/O Base 24 Vdc
Power Supply Typical Schematic

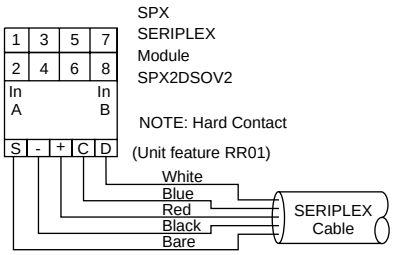


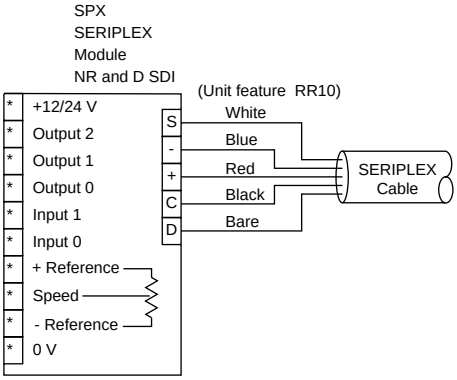
Momentum SERIPLEX I/O Base Interface to Modbus Plus Typical Schematic

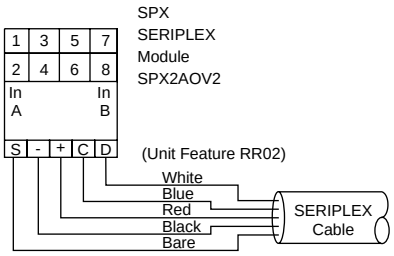
Wiring Diagrams

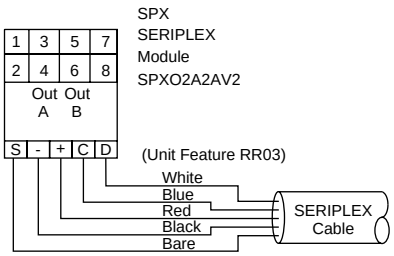


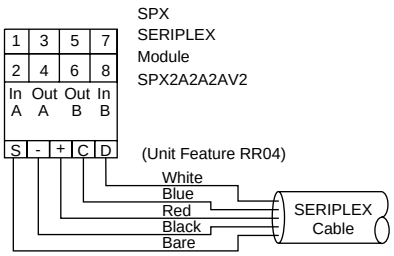
Momentum SERIPLEX I/O Base Interface to Supported Networks Typical Schematic











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