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# The Eaton CMA Advanced Sectional Mobile Valve

The CMA90 is an advanced CAN-Enabled electro-hydraulic sectional mobile valve with independent metering that utilizes pressure and position sensors, on board electronics, and advanced software control algorithms. Where conventional mobile valves often compromise on precision or response, the CMA delivers both. The CMA offers high performance with sub micron hysteresis, closed loop control over the spool position, and repeatable performance.

CMA offers customers the next generation in advanced mobile valves with unlimited possibilities to differentiate your machine capabilities.



## Features and benefits

- Precise control maintained for all load conditions
- Reduction in metering losses / energy management
- High valve responsiveness
- Flow Sharing – Pre and Post Comp Capabilities
- Flexibility in configuration with easily changed parameters
- Command factory-calibrated flow or pressure from either work port
- Easier communication with the valve
- Reduced load on the Vehicle CAN bus
- Advanced Diagnostics for improved reliability and productivity
  - Hose Burst Detection
  - Limp mode
  - Diagnostics on the inlet, tank, load sense, work port pressures, spool position, consumed flow, and oil temperature.

## Typical applications

- Platform can support future software development for future product development.
- Reliable performance across a broad temperature range
- Concrete Boom Trucks
- Utility Trucks
- Forwarders
- Agriculture Tractors
- Drill Rigs
- Snow Groomers



# Specifications And Performance

## Pressures

Inlet Rated	380 bar (5511 psi)
Inlet Max	440 bar (6382 psi)
Work Port Rated	380 bar (5511 psi)
Work Port Max	440 bar (6382 psi)
Tank*	Max 30 bar (435 psi)

## Flow

Work Port (max, measured with internal pressure sensors)	90 lpm (24 gpm) @ 7.5 bar Δ P
Max inlet flow when two sections are fully open.	200 lpm (53 gpm) @ 25 bar P-T

## Leakage\*\*

Max Leakage without Work Port Valves	20 cc @100 bar @ 21 cst
Max Leakage with Work Port Valves	30 cc @100 bar @ 21 cst

## Construction

Sectional	Up to 8 sections per block
	Up to 15 sections per VSM

## Port Types

SAE	P1 = 7/8"-14 UNF (SAE-10), P2 = 1 1/16"-12 UN (SAE-12), T = 1 1/16"-12 UN (SAE-12), LS = 7/16"-20 UNF (SAE-04), A&B = 3/4"-16 UNF (SAE-08) OR 7/8"-14 UNF (SAE-10)
BSP	P1=G 1/2, P2=G 3/4, T=G 3/4, LS=G 1/4, A&B = G 1/2

## Inlet section options

	Variable Displacement (Load Sensing)
--	--------------------------------------

## Work section options

Standard Spools	90 lpm (24 gpm)
Work Port Valves	Anti-Cavitation Port Relief & Anti-Cavitation Port Relief

## Compensation type

Digital	On meter-in and meter-out
---------	---------------------------

## Actuation

Primary	CAN
Emergency	Mechanical Override

## Control modes

	Flow
	Pressure
	Spool Position
	Float

\*With manual override, tank limited to 10 bar (145 psi) maximum. Max 30 bar is at constant rate.

\*\*Data taken from work port to tank and supply

## Temperatures

Ambient (operating)	-40°C to 105°C
Standard Oil (operating)*****	-40°C to 85°C
Extended Oil (operating)	-20°C to 105°C
Storage	-40°C to 105°C

## Filtration

ISO 4406	18/16/13
Pressure Reducing Valve	75 micron
Pilot Valve	100 micron

## Electromagnetic protection

EMC Directive 2014/30/EC ***	
Earth Moving	ISO 13766: 2006
Construction	EN 13309: 2010
Agriculture	ISO 14982:2009

## Electrical environmental\*\*\*\*

Ingress Protection	IP67
Thermal Cycling	-40C to 105C for 1000 cycles
Mechanical Shock	50G ½ sine wave, 11ms pulse

## Random Vibration

Method	MIL STD 202G, Method 214-1
Limits	Test Condition A
Duration	8 hrs/axis
# Of Axis	3 separately
Profile	Reference Appendix

## Oil Temperature viscosity

Recommended Viscosity	85 to 10 cSt
Absolute Maximum Viscosity	2250 cSt
Absolute Minimum Viscosity	7 cSt

## Electrical

Input Voltage	9 - 32 VDC
Power Consumption Range	Reference Appendix
CAN Interface	J1939 2.0B, CAN Open

## Electrical interface connectors

Deutsch (VSM)	DT06-12SB-P012
Deutsch (VSE)	DT06-12SA-P012

## Dynamic performance

Loop Time for Internal CAN	3ms
Typical Step Response	24 ms @ 15 cSt
Typical Frequency Response	17.5 Hz @ 15 cSt

\*\*\*Electronics are designed to power down and recover automatically under various power conditions (ie.. Load Dump, Ignition Cranking, Disconnection of Inductive Loads). CE testing with J1939 at 250 kb/s

\*\*\*\*Additional Electrical Environmental tests were performed. Contact Eaton for additional details, if desired.

\*\*\*\*\*It is recommended that the CMA valves not be subjected to a thermal difference of greater than 50°F (28°C).

# CMA90 Advanced Sectional Mobile Valves

## Principles of operation

The work section is comprised of two independent spools that act as a pair working to control double acting services, or alternatively as single spools controlling a single acting service (2 single axis services can be controlled from any work section).

Demands to each work section are transmitted over a CAN Bus and power is provided to each work section via a single daisy chain cable arrangement. Each work section has a single pilot valve comprised of on-board electronics, embedded sensors, and two independent 3 position 4 way pilot spools driven by a low power embedded micro controller.

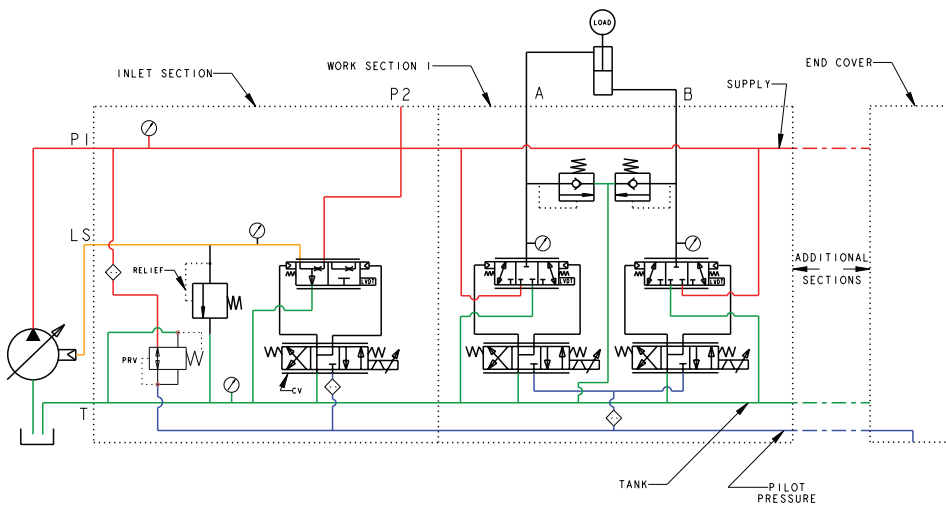
The independent pilot spools control the mainstage spools. Closed loop control of each work section is done locally by leveraging the on-board electronics and sensors.

Each mainstage spool has its own position sensor enabling closed loop position control of the mainstage spool.

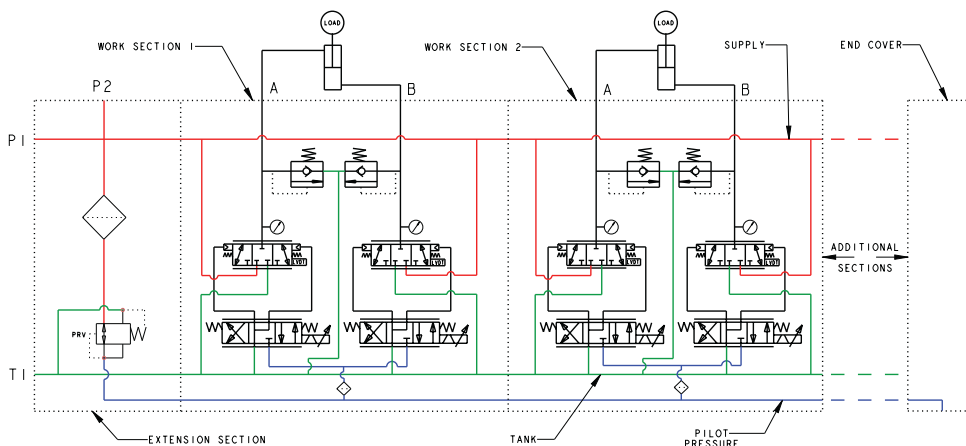
Further, a pressure sensor is located in each work port, pressure line, load sense line and tank line.

With the up and downstream pressure information known at any time, flow delivered to the service can be controlled by moving the spools to create the appropriate orifice area for the desired flow rate.

**Figure 1: CMA system with Load-Sensing Inlet & a single work-section**



**Figure 2: Extension Inlet**

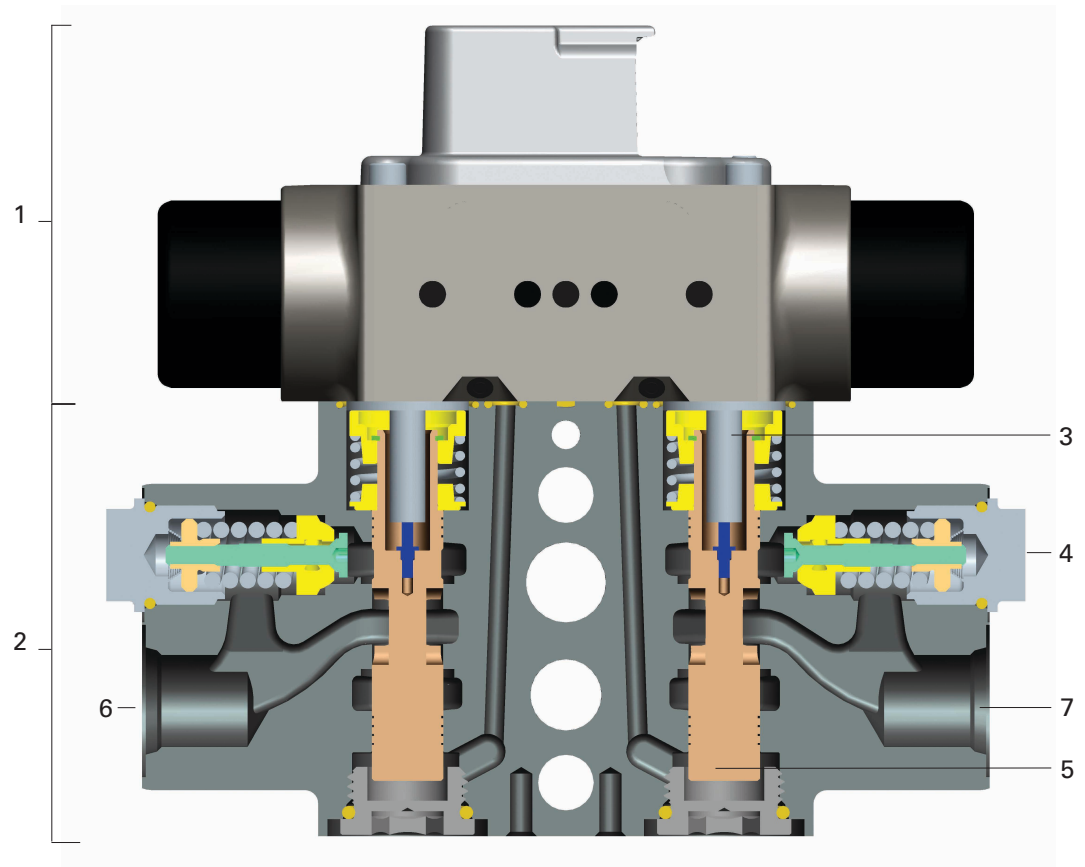


# CMA90 Advanced Sectional Mobile Valves

## Cross Sections

### Valve cross section:

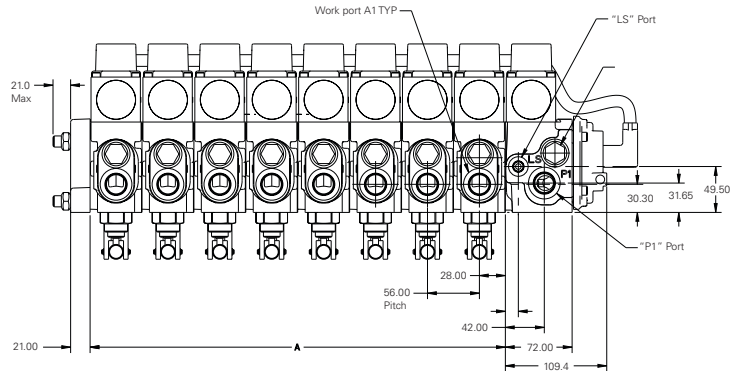
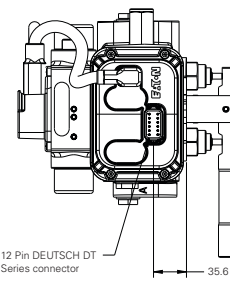
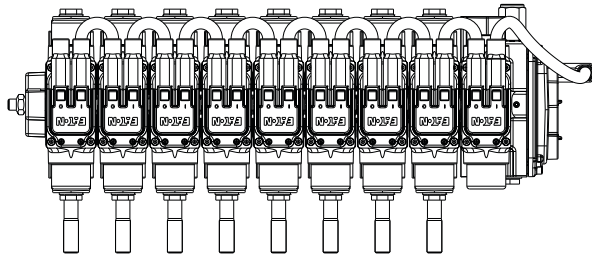
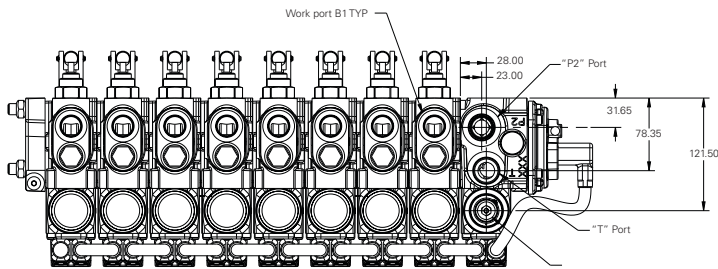
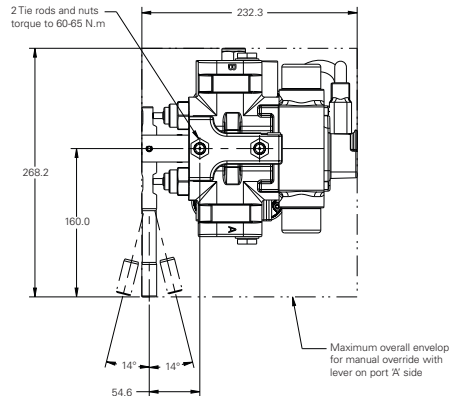
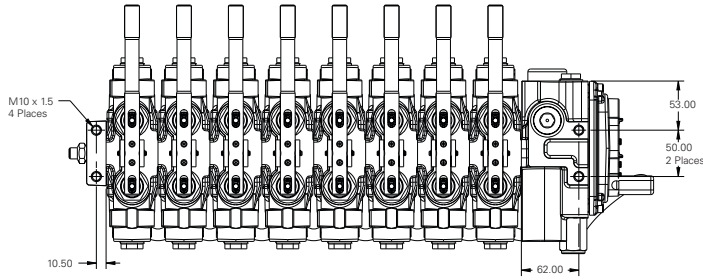
1. Pilot Valve
2. Main Stage
3. Linear Position Sensor
4. Port Reliefs / Anti-Cavs
5. Main Metering Spools
6. Work Port A
7. Work Port B



# CMA90 Advanced Sectional Mobile Valve

## CMA90 Installation Views: 8 Section Inlet Block With Manual Override

Units: mm



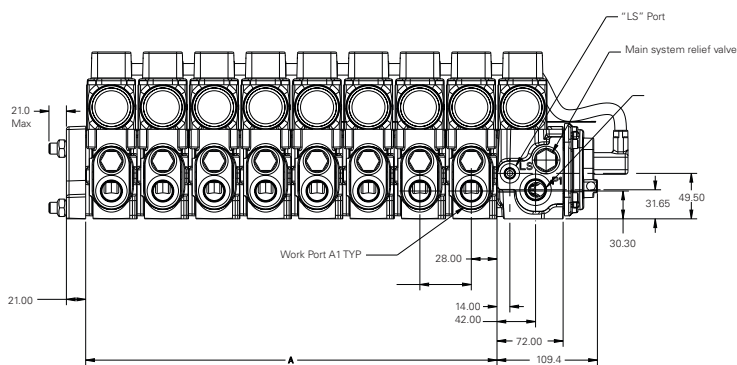
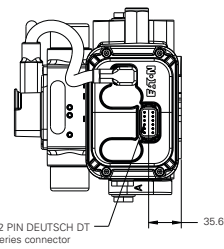
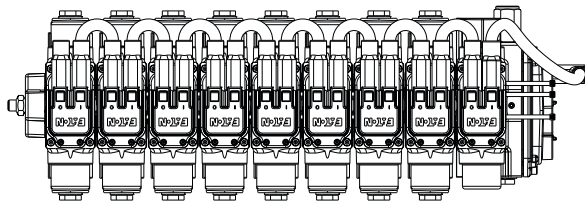
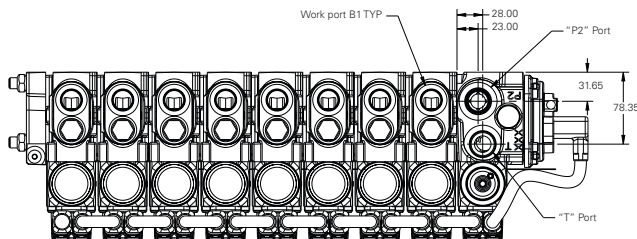
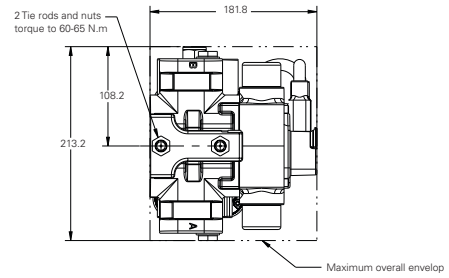
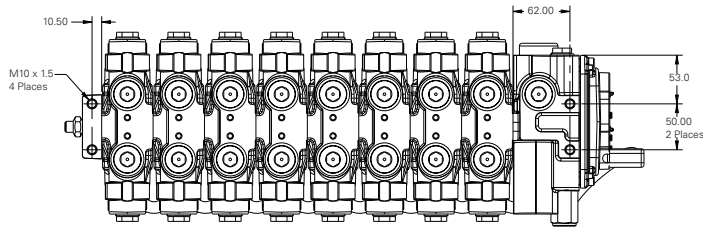
**Number of sections**

Dimension	/1	/2	/3	/4	/5	/6	/7	/8
A (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Weights (kg)	16.4	23.6	30.9	38.1	45.4	52.6	59.9	67.1

# CMA90 Advanced Sectional Mobile Valve

## CMA90 Installation Views: 8 Section Inlet Block Without Manual Override

Units: mm



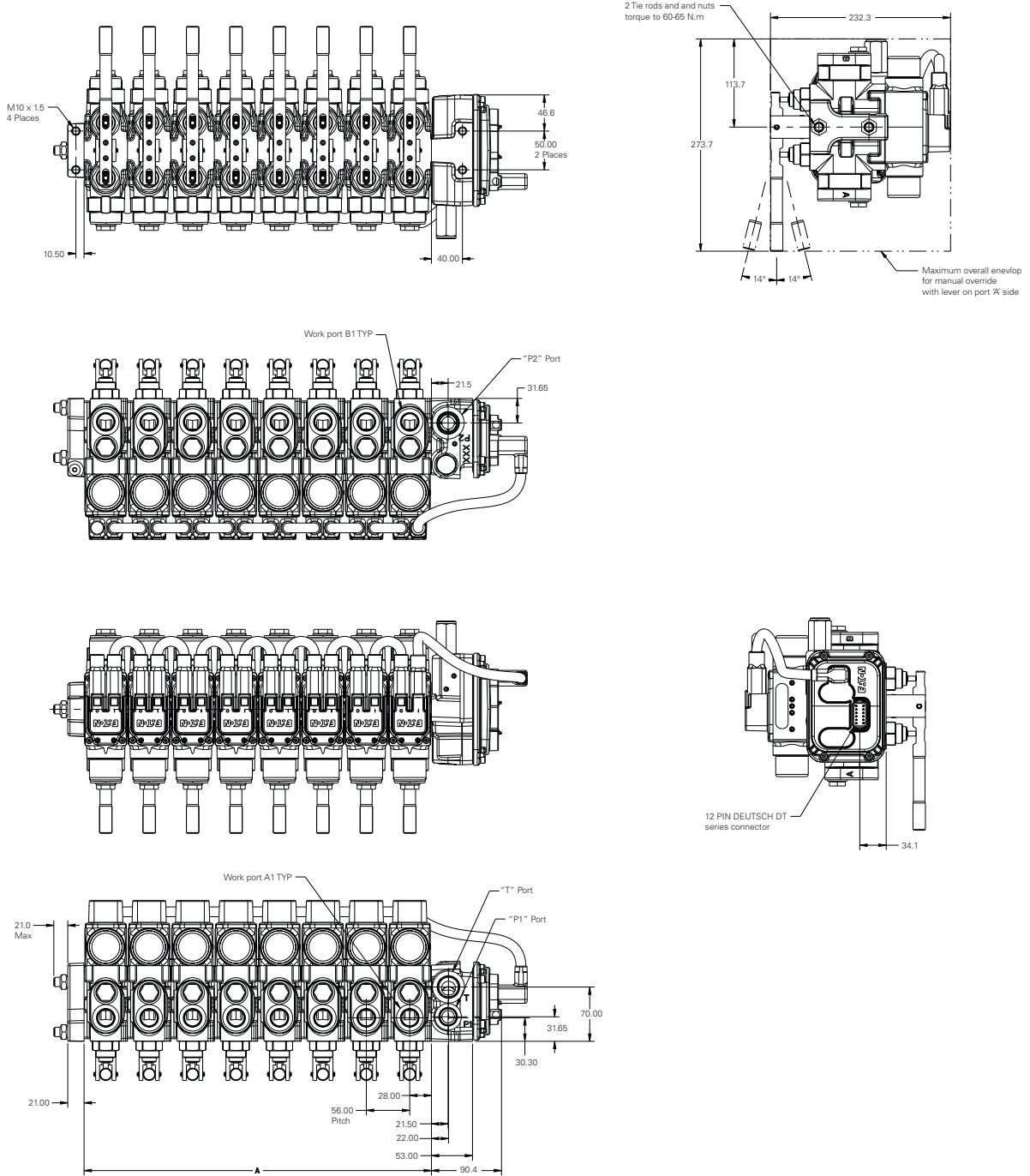
Dimension	Number of sections							
	/1	/2	/3	/4	/5	/6	/7	/8
A (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Weights (kg)	15.7	22.3	28.9	35.5	42.1	48.7	55.3	61.9



# CMA90 Advanced Sectional Mobile Valve

## CMA90 Installation Views: 8 Section Extension Block With Manual Override

Units: mm

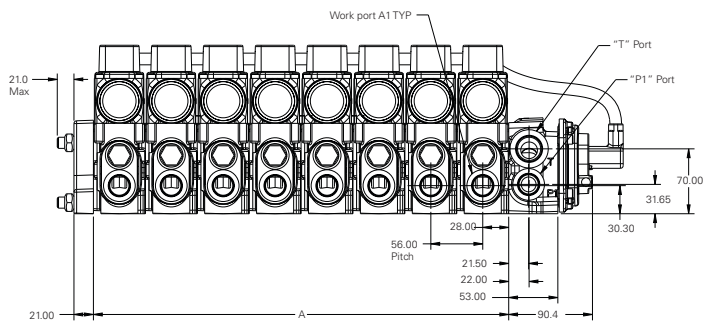
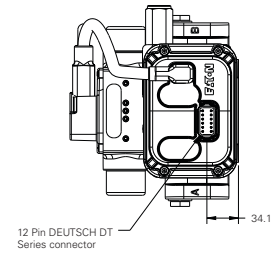
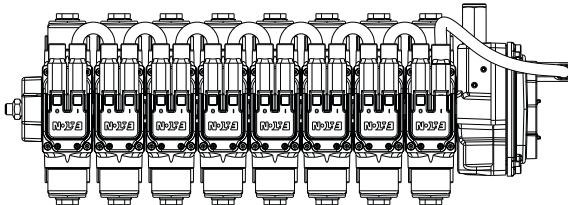
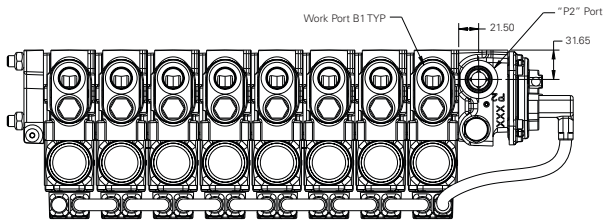
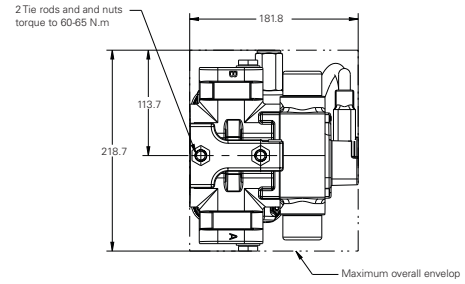
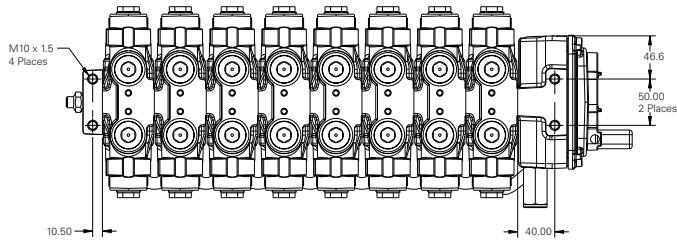


Dimension	Number of sections							
	/1	/2	/3	/4	/5	/6	/7	/8
A (mm)	56.0	112.0	168.0	224.0	280.0	336.0	390.0	448.0
Weights (kg)	12.4	19.6	26.9	34.1	41.4	48.6	55.9	63.1

# CMA90 Advanced Sectional Mobile Valve

## CMA90 Installation Views: 8 Section Extension Block Without Manual Override

Units: mm



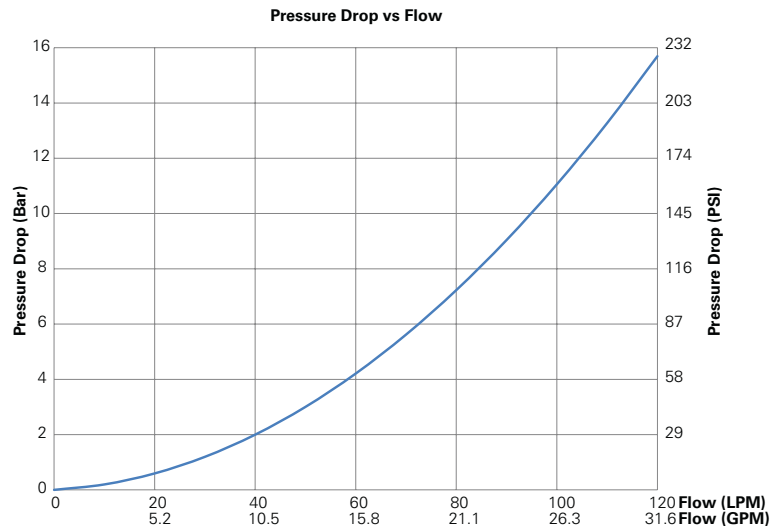
Dimension	Number of sections							
	/1	/2	/3	/4	/5	/6	/7	/8
A (mm)	56.0	112.0	168.0	224.0	280.0	336.0	392.0	448.0
Weights (kg)	11.7	18.3	24.9	31.5	38.1	44.7	51.3	58.5

# CMA90 Advanced Sectional Mobile Valves

## Typical Curves

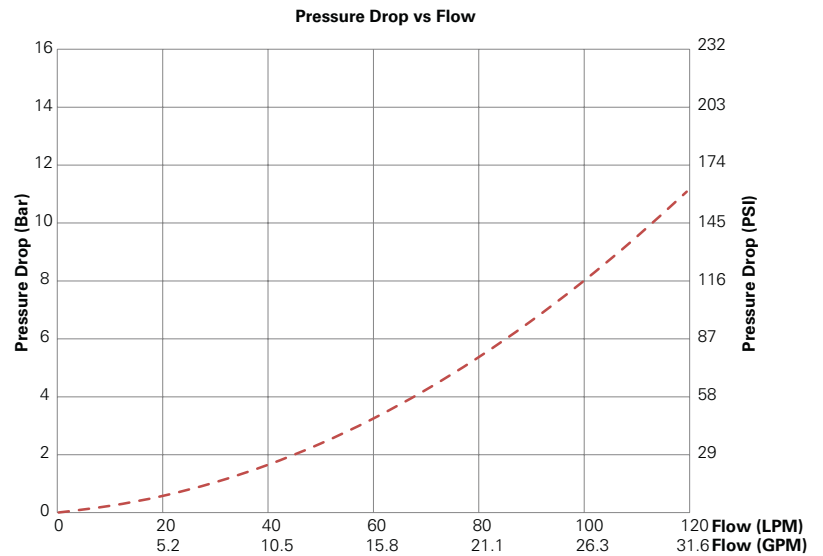
### Work section - pressure drop

Measured with external pressure sensors, inlet to work port

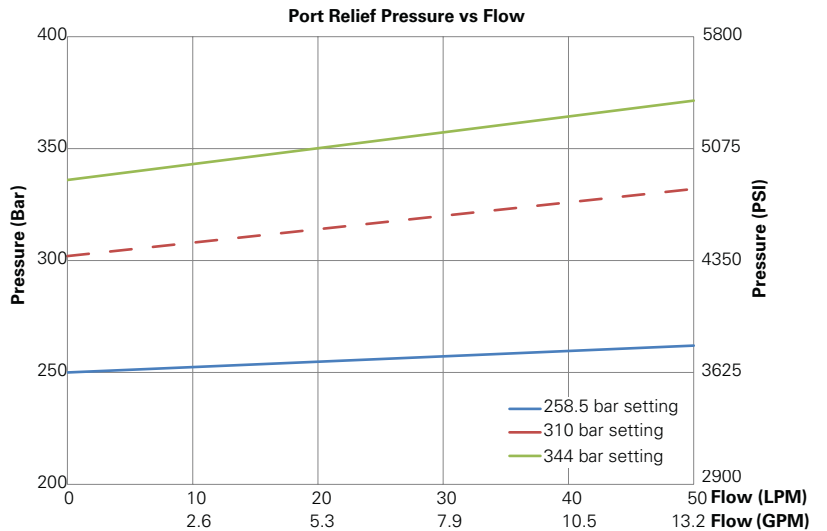


### Work section - pressure drop

Measured with external pressure sensors, work port to tank



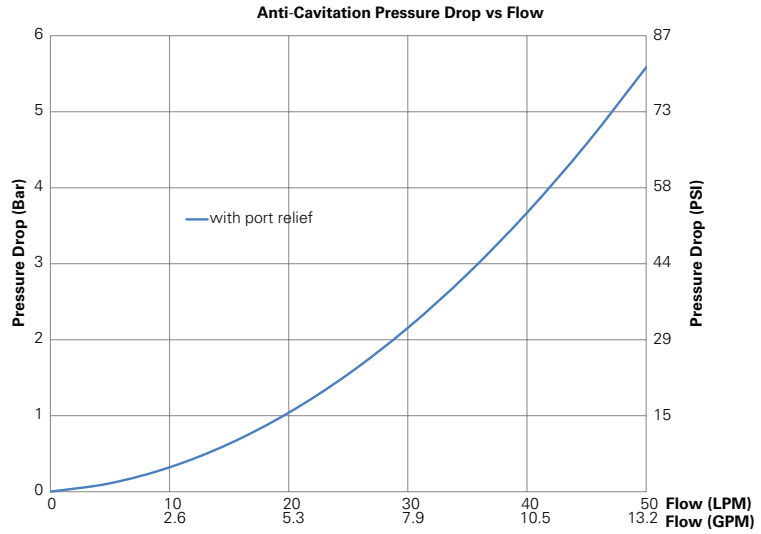
### Work section - work port relief valve



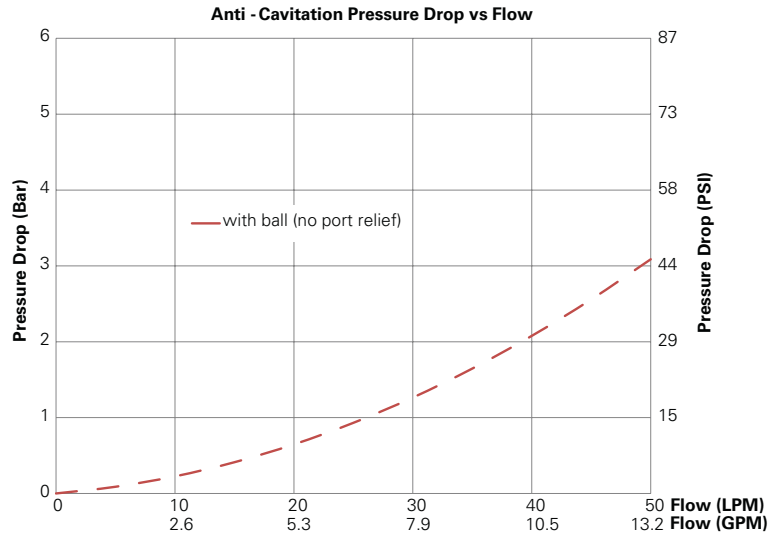
# CMA90 Advanced Sectional Mobile Valves

## Typical Curves

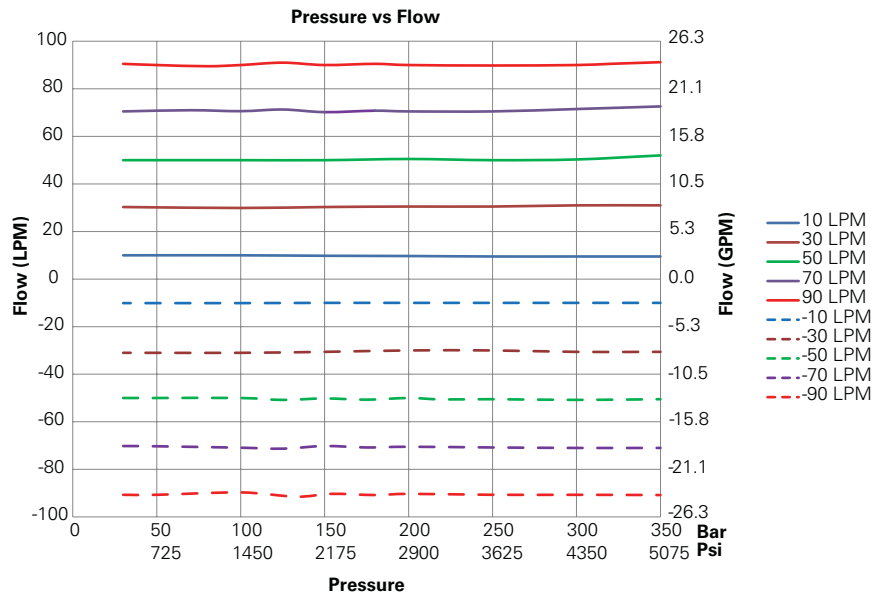
### Work section - pressure drop across anti-cav of relief valve



### Work section - pressure drop across ball and spring anti-cav



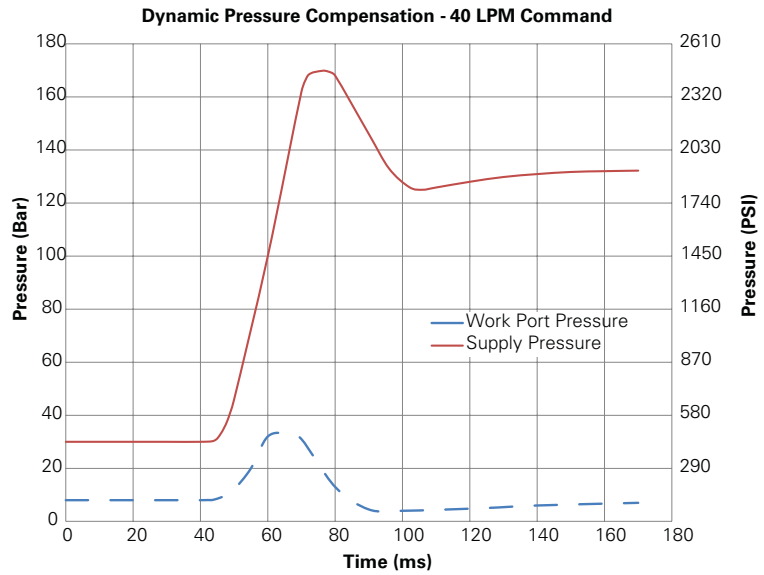
### Work section - pressure compensation



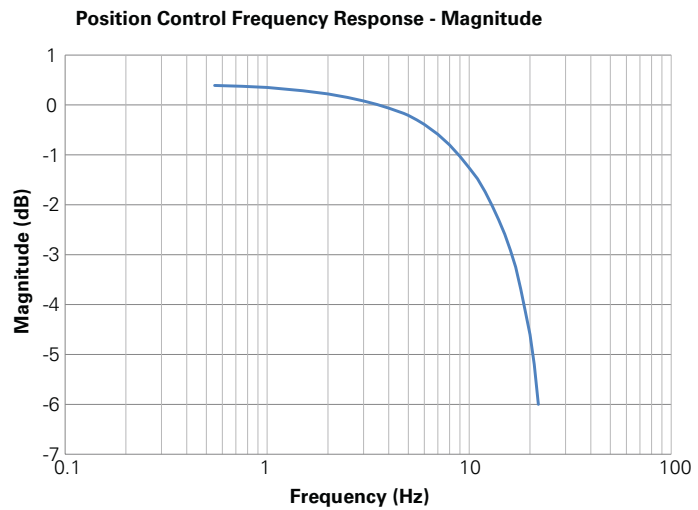
# CMA90 Advanced Sectional Mobile Valves

Typical Curves

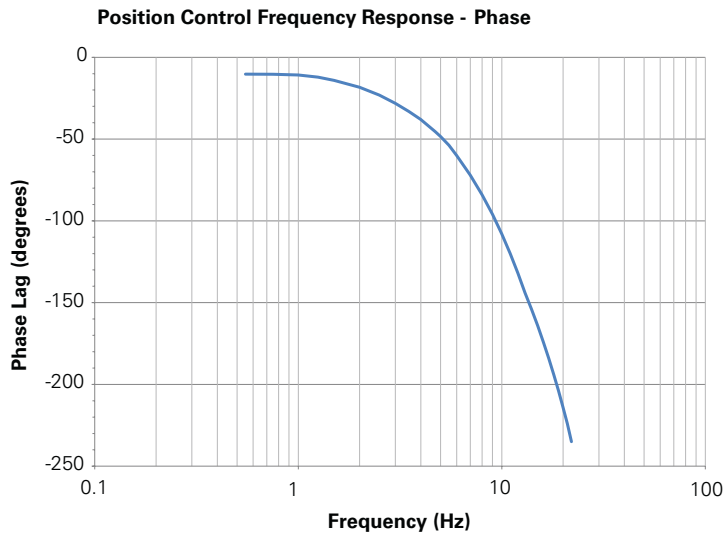
## Work section - dynamic pressure compensation



## Position control frequency response - Magnitude



## Position control frequency response - Phase



# CMA Machine Integration Process

Because of CMA's CAN communication and advanced software features, there are a couple of other additional steps to integrating a CMA valve into your machine. The following steps outline a typical integration process.

1. Specify Inlet and Sections and Purchase Valve Block assemblies, (Please reference page 15) "Specifying a CMA system" for more information.
2. Develop software for CAN communication to CMA as well as the machine's application software
  - a. Communication libraries in CoDeSys 3.5.5 are available for use on Eaton's HFX Controller or other CoDeSys programmed ECUs
  - b. If programming in another language, reference CMA's Application Developer's Guide for J1939 or CANOpen for definition of the necessary communication message structure.
3. Design and build wiring harnesses to connect from the machine to each CMA system as well as harnesses to connect between CMA valve blocks.
  - a. Cables connecting valves within a blocks will be provided by Eaton
  - b. See wiring schematic and suggested components (Please reference page 27) "CMA Wiring Harness Details" for more information.
4. Procure CAN card (Please reference page 34) "Pro-FX<sup>®</sup> Configure" for more information.
5. Once the CMA valve is received and installed on the machine, setup and tune CMA's software features using Pro-FX<sup>®</sup> Configure.

# Specifying a CMA System

For each CMA valve block desired, develop 1 inlet section model code and a work section model code for each work section on the block. When dividing work sections across multiple valve blocks, the following rules must be followed. Note, a system here refers to all of the valve blocks wired electrically together to a single VSM.



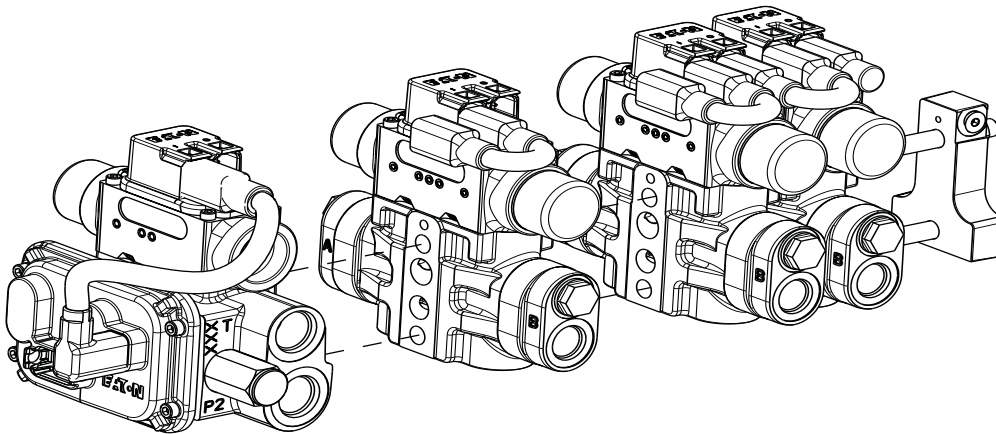
- One and only one VSM and Inlet Pressure Controller are required per system
- Maximum of 8 work sections per block
- Maximum of 15 work sections per system
- If more than 15 work sections are required, this can be accomplished by using additional CMA systems. Each additional system will appear as another node on the User CAN network

## Valve block order example

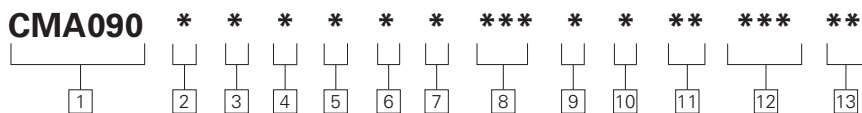
1. Inlet	CMA090 J M S V 3 0 000 K 1 00 XXA 10
2. Section 1	CMZ090 B MC B 379 MC B 379 0 K 1 00 XXA 10
3. Section 2	CMZ090 B MC B 379 MC B 379 0 K 1 00 XXA 10
4. Section 3	CMZ090 B MC B 379 MC B 379 0 K 1 00 XXA 10

**Note:** Repeat section model code for additional sections.

**Note:** End cover, tie rods, and cables to connect between the valves on the block are provided by default.



# Model Code For Inlet Section



**1 CMA090 Series**

**2 Communication Protocol**

- J J1939
- C CAN OPEN
- 0 None

**3 Interface Module**

- M VSM
- E VSE
- 0 None

**4 Port Types**

- S SAE P1 = 7/8"-14 UNF (SAE-10)
- P2 = 1 1/16"-12 UN (SAE-12)
- T = 1 1/16"-12 UN (SAE-12)
- LS = 7/16"-20 UNF (SAE-04)
- B BSP P1= G 1/2
- P2= G 3/4
- T = G 3/4
- LS= G 1/4

**5 Inlet Pressure Controller**

- V Variable Displacement
- 0 none, Used on VSE or extension block

**6 Active Pressure Port**

- 1 P1
- 2 P2
- 3 P1 & P2

**7 Manual Override**

- 0 None
- M Manual Override on CV

**8 Main Relief Setting (In bar)**

- 000 = None
- 155            293
- 172            310
- 190            328
- 207            345
- 224            362
- 241            379
- 259            397
- 276            414

**9 Paint Type**

- K Std. Flat Black

**10 Seals**

- 1 Default

**11 Special Features**

- 00 None

**12 Software Version**

- XXA Standard Software

**13 Design Code**

- 10 Design Code

**Note:** A pressure limit can be set on the valve in software to any value in increments of 0.01 bar using available configuration software suite. This applies to both inlet and work port settings.





# CMA Inlet – Communication Protocol

## Model Code Position 2

CMA is a CAN controlled valve that can communicate with either J1939 or CAN open networks.

- J** - The J1939 version of the valve is seen as one node on the user CAN network and operates at 250 kb/sec as specified by J1939. The valve is addressed using a single 29 bit extended identifier.
- C** - The CANOpen version of the valve utilizes an 11 bit identifier with configurable baud rates of 125, 250, and 500 kb/sec. The valve system will be one node on the CAN open network.
- 0** - If this block is an extension block and does not have a VSM, no communication protocol needs to be selected.

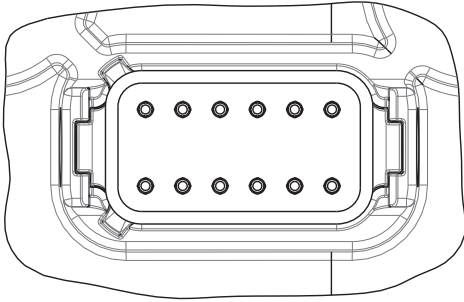
# CMA Inlet – Interface Module

Model Code Position 3

## M - VSM (Valve system module)

This is the interface module for the valve – it acts as a CAN gateway, a DC to DC power supply, and a supervisory controller for the system.

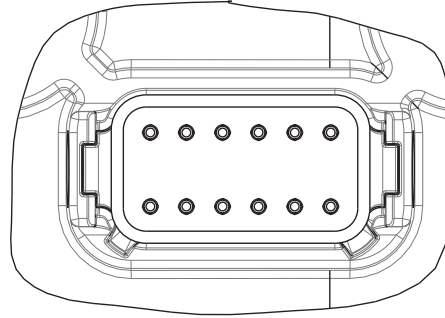
Every CMA system must have one and only one VSM.



VSM 12 pin connector "B" Keying

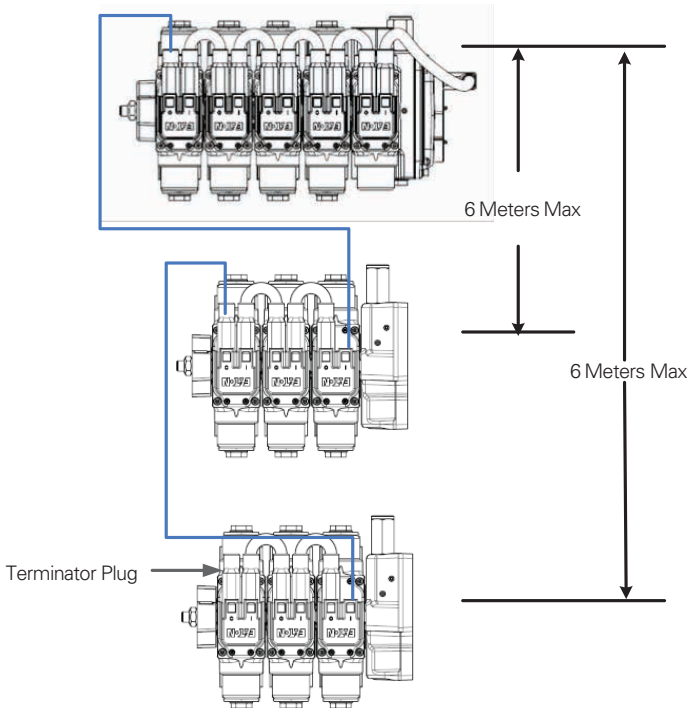
## E - VSE (Valve system extender)

This is used on blocks where the distance between it and the VSM or a VSE is greater than 6 meters (19.6 feet). Maximum distance between a VSE and its VSM is 30 meters (98.4 feet)

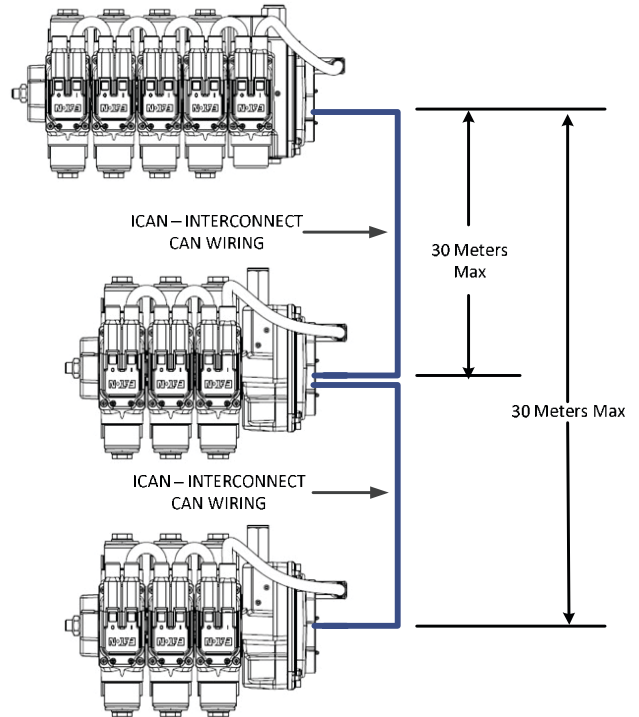


VSE 12 pin connector "A" Keying

## System layout without VSE's



## System layout with VSE's



## 0 - None

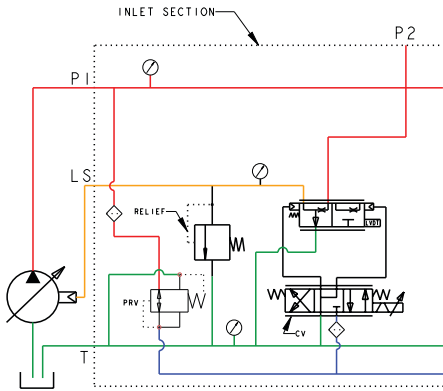
This is selected for blocks where the distance between it and the VSM or a VSE is less than 6 meters (19.6 feet). This block would be connected with an extension cable to the last PV on the closest block.

# CMA Inlet – Inlet Pressure Controller

Model Code Position 5

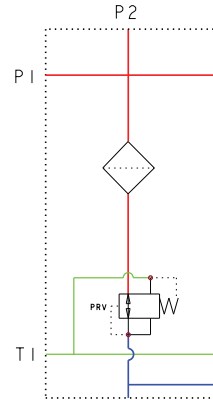
## V – Variable displacement

A variable displacement inlet has a load sense port for connecting to a variable displacement pump. Each CMA system needs one and only one Inlet Pressure Controller.



## 0 – None

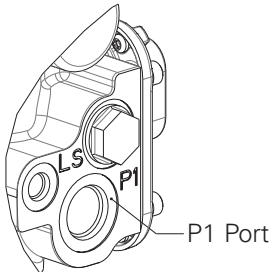
If this is for an extension block, with or without a VSE, no Inlet Pressure Controller is needed. An extension inlet will be installed on the block that has supply and tank ports but no load sense port.



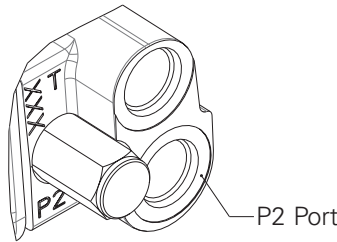
# CMA Inlet – Active Pressure Port

Model Code Position 6

## 1 – P1



## 2 – P2



## 3 – P1 & P2

# CMA Inlet – Manual Override

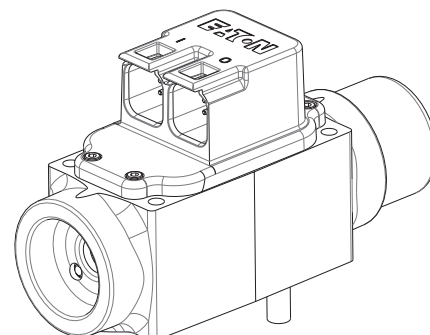
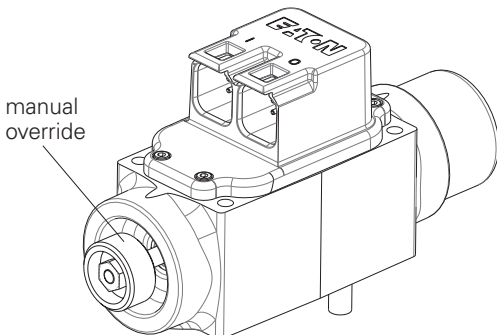
Model Code Position 7

## M – Manual Override on CV

A manual override is installed on the CV, or Conditioning Valve, that can be used to control the supply pressure. This manual override allows a user to force supply pressure to its maximum if electrical power is lost. This would be necessary if a manual override needed to be actuated to raise a service without electrical power. Electrical Power is necessary for the Work Sections to be able to communicate their Load Sense demands to the Inlet over CAN.

## 0 – None

No manual override is installed



# CMA Inlet – Software Versions

## Model Code Position 12

The Software Version position is broken up into two sections, the first 2 characters designating the major software version, and the last character designates the software options desired

### **Software major version**

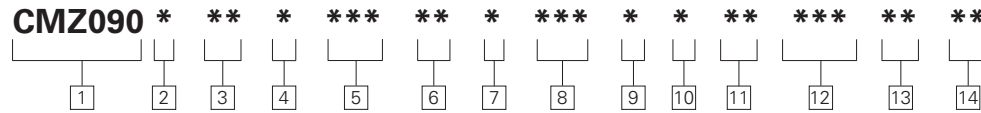
The first two characters in Software Version should indicate the major version of software desired.

If a specific major version is desired, the major version desired is indicated, for example, 03 for software with a major version 3. For CMA, all versions of software that have the same major version are compatible, for example, version 3.8 and version 3.9. The software version of CMA valves already purchased can be found using Pro-FX<sup>®</sup> Configure.

If the latest major version of software available is desired, these characters should be XX.

The valve will always be shipped with the most up-to-date minor software version available for the designated major version.

# Model Code – Work Section



**1 CMZ090 Series**

**2 Body Port Thread Sizes**

- A 3/4" 16 UNF (SAE-8)
- B 7/8" 14 UNF (SAE-10)
- D G 1/2"

**3 Spool Type at Position A**

- MC 90 lpm, biased to center
- MT 90 lpm, biased to tank
- MP 90 lpm, biased to pressure

**4 Valve Option at A**

- 0 None
- B Anti-cavitation valve with relief valve
- C Anti-cavitation valve
- S Relief valve

**5 Relief Setting at Position A**

- RV Setting in Bar  
000 = None
- |     |     |
|-----|-----|
| 155 | 293 |
| 172 | 310 |
| 190 | 328 |
| 207 | 345 |
| 224 | 362 |
| 241 | 379 |
| 259 | 397 |
| 276 | 414 |

**6 Spool Type at Position B**

- MC 90 lpm, biased to center
- MT 90 lpm, biased to tank
- MP 90 lpm, biased to pressure

**7 Valve Option at B**

- 0 None
- B Anti-cavitation valve with relief valve
- C Anti-cavitation valve
- S Relief valve

**8 Relief Setting at Position B**

- RV Setting in Bar  
000 = None
- |     |     |
|-----|-----|
| 155 | 293 |
| 172 | 310 |
| 190 | 328 |
| 207 | 345 |
| 224 | 362 |
| 241 | 379 |
| 259 | 397 |
| 276 | 414 |

**9 Manual Override Type**

- 0 None
- A Lever-handle toward port A
- B Lever-handle toward port B

**10 Paint Type**

- K Std. Flat Black

**11 Seal**

- 1 Default (NBR)

**12 Special Features**

- 00 None

**13 Software Version**

- XXA Standard Software
- XXU Advanced Control Package
- XXV Advanced Service Package
- XXT All Packages (Standard plus all Advanced Packages)

**14 Design Code**

- 10 Design Code

**Note:** A pressure limit can be set on the valve in software to any value in increments of 0.01 bar using available configuration software suite. This applies to both inlet and work port settings.

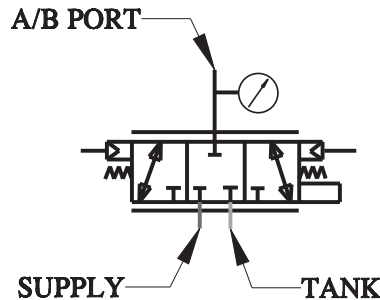
**Note:** If an option without a relief is selected for port A or B, no relief valve setting should be selected in corresponding Relief Setting position (i.e., select 000). Likewise, when selecting a valve option with a relief, make sure to select a corresponding relief setting.

# Work Section Options - Spool Type At Position A and Position B

Schematic Of Spool Types For  
Model Code Position 3 And 6

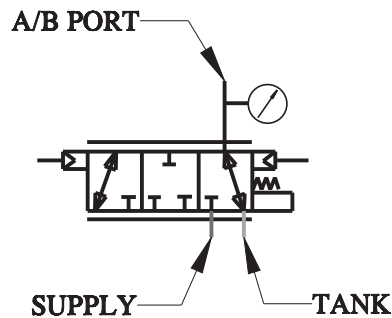
## MC - Biased to center

In biased to center, the spring will move the spool to the center position when there is no power to the coils or no pilot pressure. In the center position, the flow to both pressure and tank is blocked



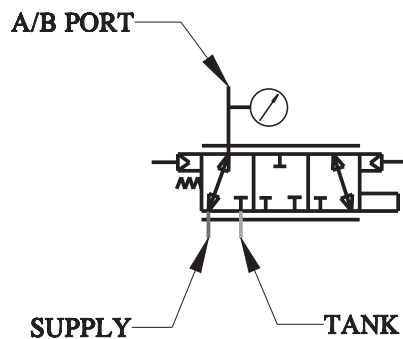
## MT - Biased to tank

With a tank-biased spool, the spring will push the spool to fully open the Work Port (A or B) to the Tank rail when the valve receives an Idle demand or when there is no electrical power



## MP - Biased to pressure

With a Pressure-biased spool, the spring will push the spool to fully open the Work Port (A or B) to the Pump rail when the valve receives an Idle demand or when there is no electrical power



## Choosing the mechanical bias condition

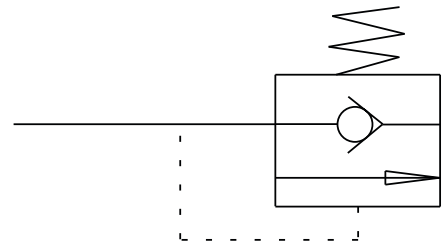
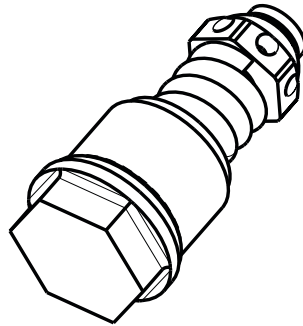
For most applications it's recommended to use a center-biased spool (MC). Otherwise, a Tank-biased (MT) or Pressure-biased (MP) can be used depending on the behavior desired when the valve is at idle or electrical power is lost.

**Note:** Since control behavior of each spool can be commanded from the vehicle's controller, any combination of spools can act like a cylinder spool arrangement, motor spool arrangement, etc. Thus, many different spool options are not necessary for CMA like for a traditional Mobile Valve.

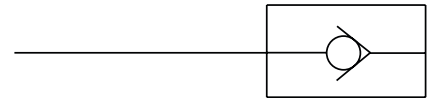
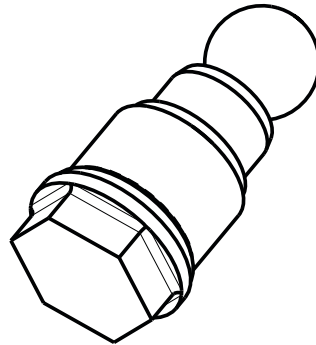
# Work Section Options - Port A & B Functions And Settings

Model Code Position 4 And 7

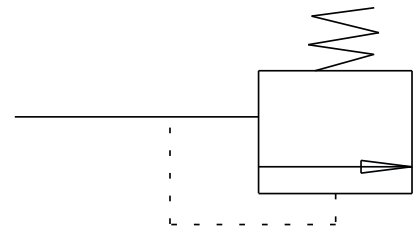
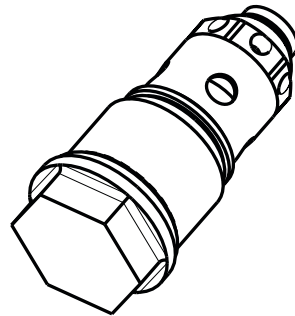
## B - Anti-cavitation valve with relief valve



## C - Anti-cavitation valve



## S - Relief valve



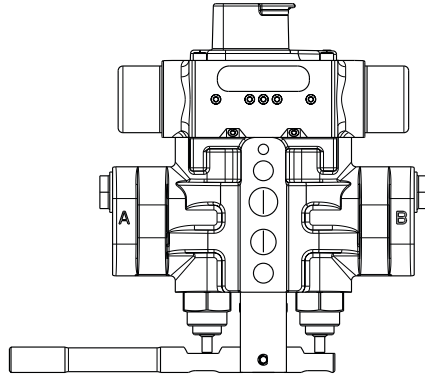
**0 - None** No port for auxiliary valves is machined.

**Note:** If an option without a relief is selected for port A or B, no relief valve setting should be selected in the corresponding Relief Setting position (i.e. select 000). Likewise, when selecting a valve option with a relief, make sure to select a corresponding relief setting.

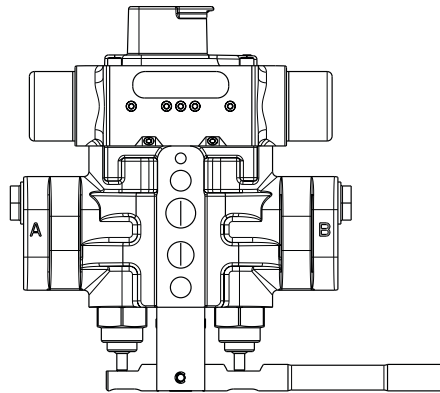
# Work Section Options - Manual Override Types

Model Code Position 9

## A - Lever-handle toward port A



## B - Lever-handle toward port B



## 0 - None

**Note:** Manual override is for emergency use only. If a Work Section's manual override is actuated alone, the pump will not respond to the load in the cylinder and the load can only be lowered. In order to raise a load if electrical power is lost but hydraulic power remains, a manual override on the inlet must have been selected in its model code to be able to force the supply pressure to be increased to its maximum.



# Work Section Options – Software Versions

Model Code Position 13

The Software Version position is broken up into two sections, the first 2 characters designating the major software version, and the last character designates the software options desired

## **Software major version**

The first two characters in Software Version should indicate the major version of software desired.

If a specific major version is desired, the major version desired is indicated, for example, 03 for software with a major version 3. For CMA, all versions of software that have the same major version are compatible, for example, version 3.8 and version 3.9. The software version of CMA valves already purchased can be found using Pro-FX<sup>®</sup> Configure.

If the latest major version of software available is desired, these characters should be XX.

The valve will always be shipped with the most up-to-date minor software version available for the designated major version.

# Work Section Options – Software Versions (continued)

Model Code Position 13

## A - Standard software control features

<b>Software</b>	<b>Description</b>
Pressure compensated flow control	Load-independent flow control
Flow compensated pressure control	Single service pressure control while either sinking or sourcing flow.
Intelli float	Lowers the load at a configurable rate and then enters full float mode
Standard ratio flow share (with priority capability)	Pre or post comp capabilities in one valve block. All service flow demands are reduced by the same ratio. Can also exempt services from flow-sharing to maintain priority. This feature prevents the pump from saturating when flow demands to the valve sum to be larger than the pump can provide.
Intelligent twin spool flow control (IFC)	Versatile flow controller which maintains the desired flow independent of transitions between passive and overrunning loads
Load damping	A feature of IFC and UFC which reduces service oscillation induced by moving large structures, such as a boom.
Electronic load sense enabled	Enables operation with a compatible pump or when multiple CMA systems are present on the same CAN network
Electronic work port relief valve	Configurable electronically controlled relief valve against externally applied loads
Electronic work port pressure limit (feed reducer)	Configurable electronically controlled pressure limit applied to user flow demands without consuming additional pump flow
Single spool flow control	Sink or source flow on individual service ports
Single spool position control	Direct spool position control on each spool
Smart Data	Diagnostics on all on-board sensors. Inlet, Tank, LS, Work Port pressures, Spool Positions, oil temperature sensor data availability.

## U – Advanced control package

<b>Software</b>	<b>Description</b>
Torque Control	Advanced force or torque control for double-acting cylinders or motors
Data control package	Broadcast of each spool's flow consumption
Cascade and Uniform Flow Share	Cascade: maintains demanded flow to selected high priority services by reducing flow to lowest priority services Uniform: All flow demands are reduced by the same absolute amount (i.e. all reduced by 1 lpm)

## V – Advanced service package

<b>Software</b>	<b>Description</b>
Hose burst detection	Prevents major oil spill events by monitoring flow consumption on each service and closing the spools for that circuit if a major leak is detected
Limp mode	If a sensor fails, the valve will continue to work with reduced performance until the machine can be serviced

## T – All Packages

Includes Standard, Advanced Control, and Advanced Service packages

# CMA Wiring Harness

All CMA blocks ship from the factory with cables installed for communication within the valve block. Eaton does not supply User Cables and Extension Cables to connect CMA blocks to the machine and each other. As a courtesy to the user, the following pages provide recommended parts and schematics for building these harnesses. Eaton recommends that the user cables and Extension Cables be assembled and verified by a licensed electrician. Eaton provides no warranties, representations and guarantees regarding the user cables and Extension Cables. The user bears full responsibility for proper assembly, installation and operation of the User Cables and Extension Cables.

## User Cables

The following diagrams provide information on how the User Cable interfaces with a number of different CMA system configurations. Throughout these diagrams User CAN (UCAN) refers to the machine's CAN network (either J1939 or CANOpen) and Interconnect CAN (ICAN) refers to the internal CAN network within CMA that jumps between CMA valve blocks. If application specific Electromagnetic Compatibility testing indicates CAN cable shielding is needed, connect CAN shield as shown

## Recommended parts for building User Cables

The following parts are recommended when building a cable. Reference the schematics on the following pages for how to build the User Cables. Or for a sample User Cable assembly drawing, please locate the drawings 6034034-001 (1 VSM block, 2 VSE blocks) or 6035189-001 (1 VSM block) on the PowerSource® Application.

	<b>Part number</b>	<b>Description</b>
Compatible Interface Deutsch Connector	DT06-12SB-P012	12-way plug connector body (VSM)
	DT06-12SA-P012	12-way plug connector body (VSE)
Deutsch Wedge Locks	W12S-P012	Wedge locks for 12-way plugs
Deutsch Sockets	0462-201-16141	Sockets for 18AWG wires
	0462-20X-16141	Sockets for Battery +, Battery - for VSM and VSE. Select "X" based on wire gage selected*
Deutsch Backshells	1028-043-1205	Backshell for 12-way plugs
Deutsch Sealing Plugs	0413-217-1605	Plugs for empty pins on connectors
Wire	SAE J1128 GXL, Crosslinked Polyethylene, 18AWG	Wire for UCAN and ICAN
	SAE J1128 GXL, Crosslinked Polyethylene, wire gage dependent on power consumption*	Wire for Battery +, Battery - for VSM and VSE
Corrugated Loom	Panduit CLTS50NC630 or Delfingen 34442	Corrugated loom for wire protection

\* Wire AWG for the Power wires to the VSM and VSE assemblies may be increased up to a maximum of 14 AWG w/GXL type insulation. This should be done to guarantee a minimum voltage of 9.5vdc is supplied to the VSM/VSE under worst case supply and load conditions.

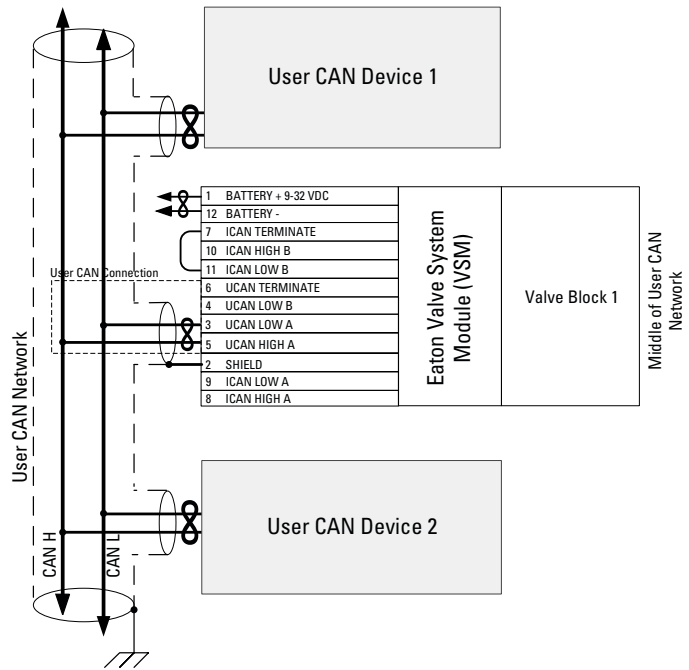
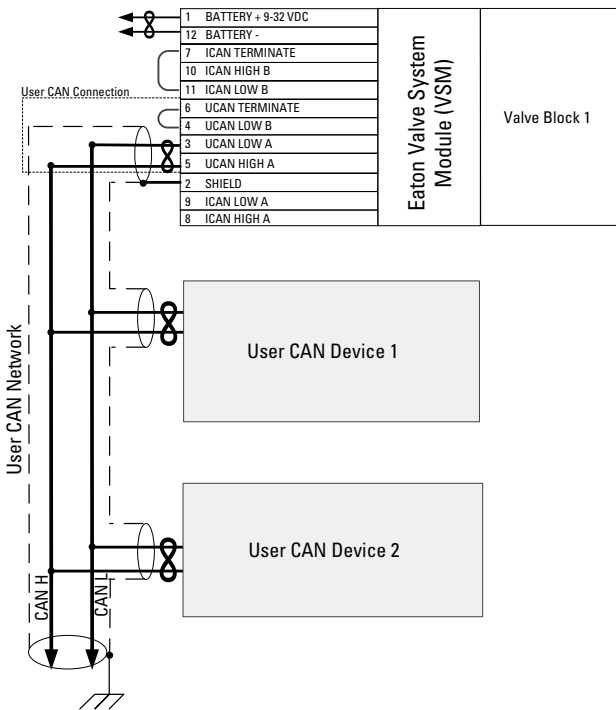
# CMA Wiring Harness Details


## User Cables Termination

User CAN, or UCAN, is the machine's CAN network that communicates with the VSM.

If the VSM is at the end of the UCAN network, a 120 ohm termination resistor built into the VSM can be used to terminate the UCAN with the installation of a wire jumper, as shown in the left figure below.

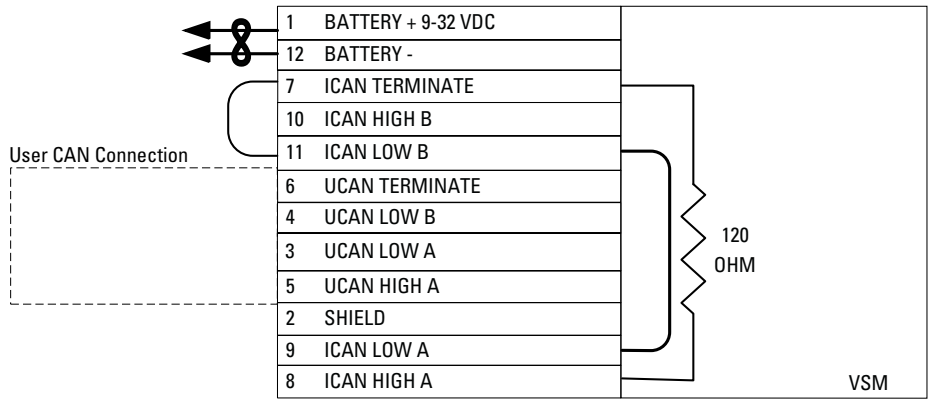
If the VSM is in the middle of the bus, no UCAN termination is necessary. The UCAN lines to the VSM must be a stub off of the main CAN harness, as shown in the right figure below.



**Note:** Symbol  is used to represent twisted pair wires. Shielding is option and was not used to a CE EMC limits..

# CMA Wiring Harness Details

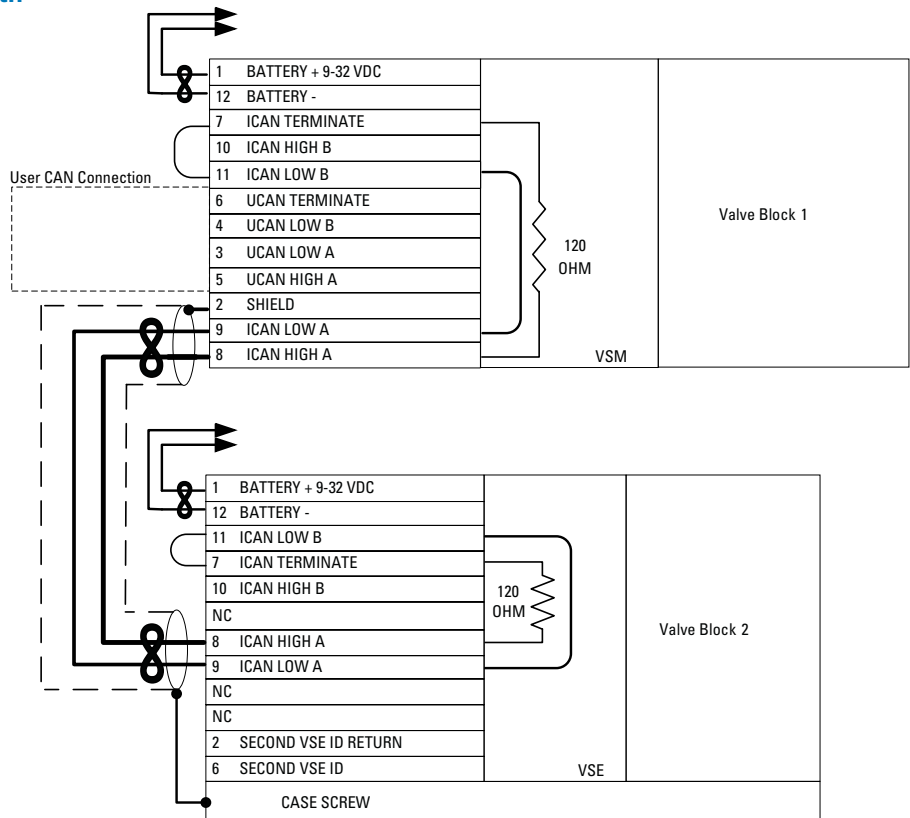
## Single block system



## Interconnect CAN Termination

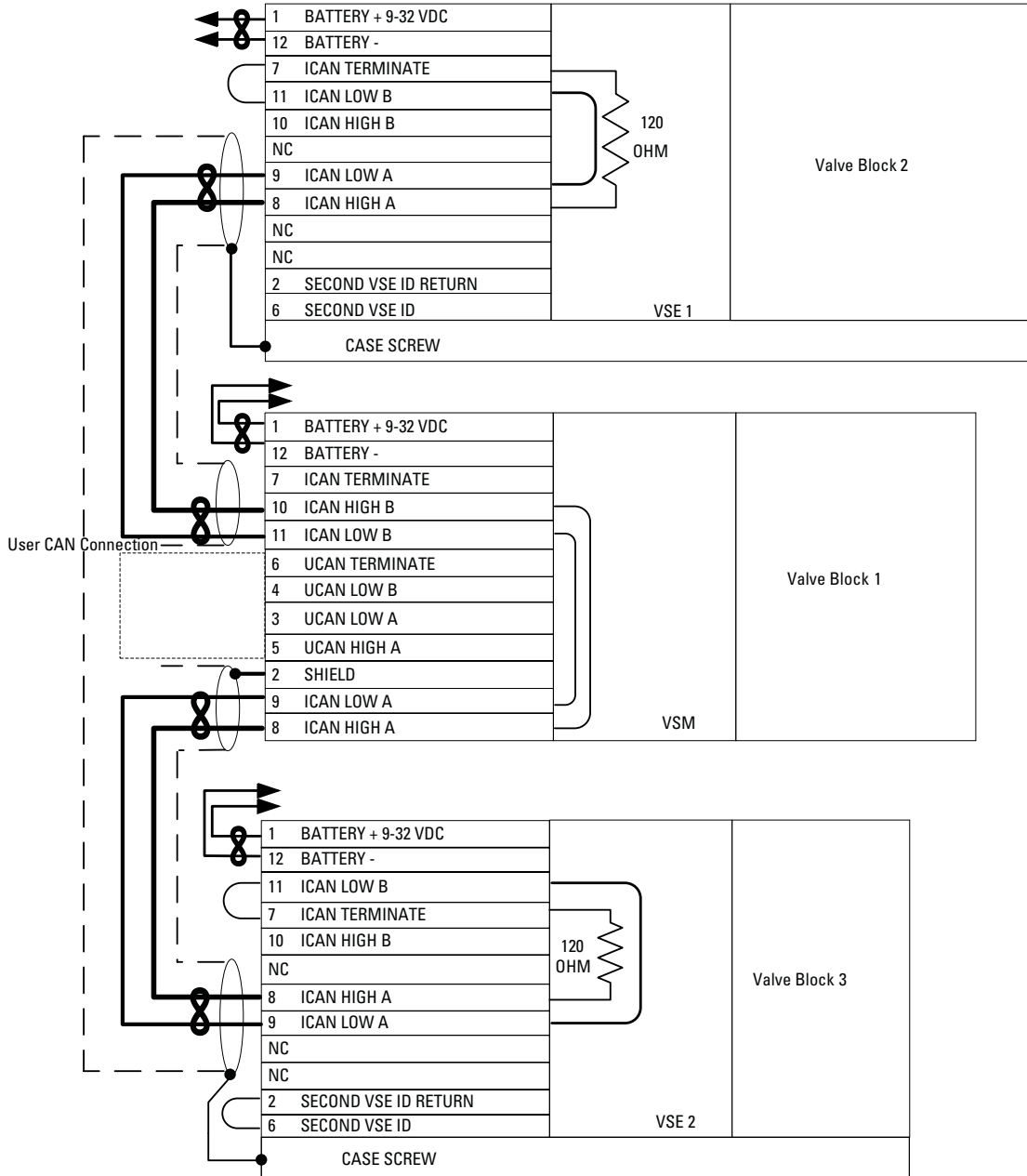
Interconnect CAN, or ICAN, is the CAN network between the VSM and VSE's. 120 ohm termination resistors in the VSM and VSE's circuits can be connected with the installation of wire jumpers each device. Two sets of ICAN pins are available in a VSM or VSE to allow daisy chaining ICAN if a VSM/VSE is in the middle of the CMA system. If no VSE's exist in a system, it is still necessary to install a jumper to activate one 120 ohm termination resistor on the ICAN bus.

## Double block system with valve system extender (VSE)



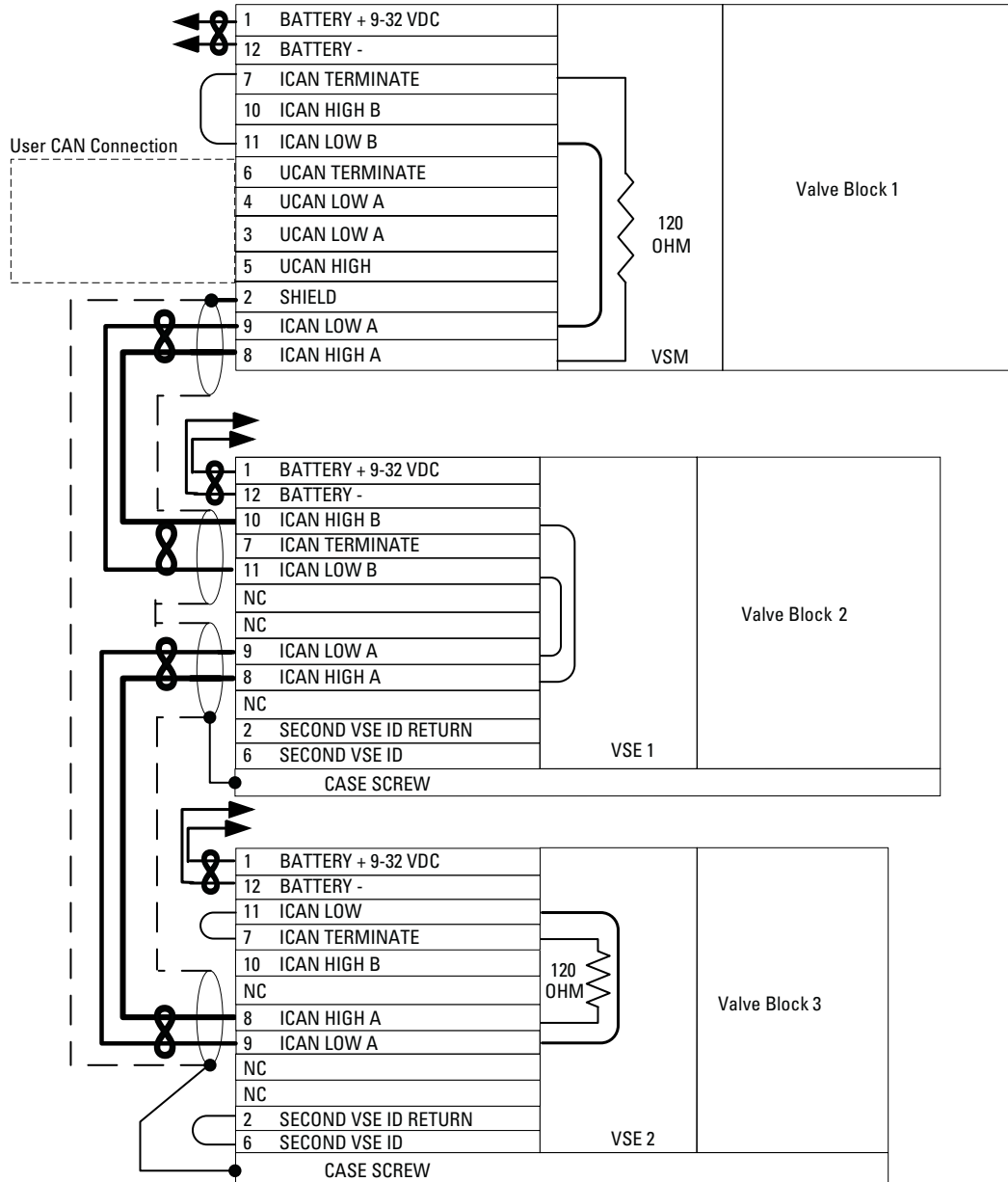
# CMA Wiring Harness Details

## Triple block system with VSM between VSEs



# CMA Wiring Harness Details

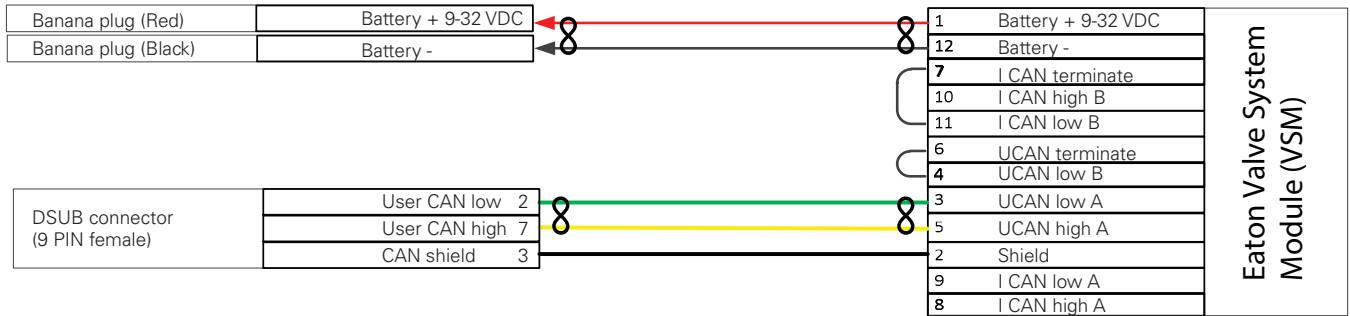
## Triple valve block system with VSM at the start of the system



# CMA Wiring Harness Details

## Example bench testing harness

When connecting to a CMA valve not installed on a machine, for example on a test bench, wiring is necessary to provide electrical power and CAN communication to a CAN card. The schematic below could be used to connect to a 1 block CMA system. The schematic would need to be modified per the previous wiring harness pages if there were additional blocks within the system that had VSE's.





# CMA Wiring Harness Details

## Extension cables

An Extension Cable can be used to connect from one CMA block to another block that is within 6m of a VSM or VSE. This cable can either be purchased from Eaton or built using the recommendations below. To install the Extension Cable, remove the Termination Plug from the last section of the block to extend from and insert the Extension Cable. Connect the other end of the Extension Cable to the Extension Block.

## Purchasable cables (when connecting an extension block to a VSM block [<6m])

	Part number	Description
Extension Cables	6034654-201	2.0 meter interconnection cable
	6034654-401	4.0 meter interconnection cable

Notes: If more than one cable is used in a single daisy chain with multiple valve blocks, then the combined lengths must be <=6m.

## Recommended parts for building cables

If an Extension cable of a different length than 2 or 4 meters is desired, the following parts are recommended when building a cable. Reference the schematic below for how to build the Extension Cable. Or, for a sample Extension Cable assembly drawing, please locate the drawing 6034654-001 on the PowerSource® Application.

	Part number	Description
Compatible Interface Deutsch Connector	DT06-6S-P012	6-way plug connector body
Deutsch Wedge Locks	W6S-P012	Wedge locks for 6-way plugs
Deutsch Sockets	0462-201-16141	Sockets for 18AWG wires
Deutsch Backshells	1011-239-0605	Backshell for 6-way plugs
Wire	SAE J1128 GXL, Crosslinked Polyethylene, 18AWG	Wire for Extension Cables
Corrugated Loom	Panduit CLTS50NC630 or Delfingen 34442	Corrugated loom for Extension Cables

## Extension cable schematic



Pro-FX<sup>®</sup> Configure is the PC tool used to configure the various software features of the CMA valve. It can also be used to check alerts, take and load backups of the valve, plot data from the valve, and send commands to the valve.

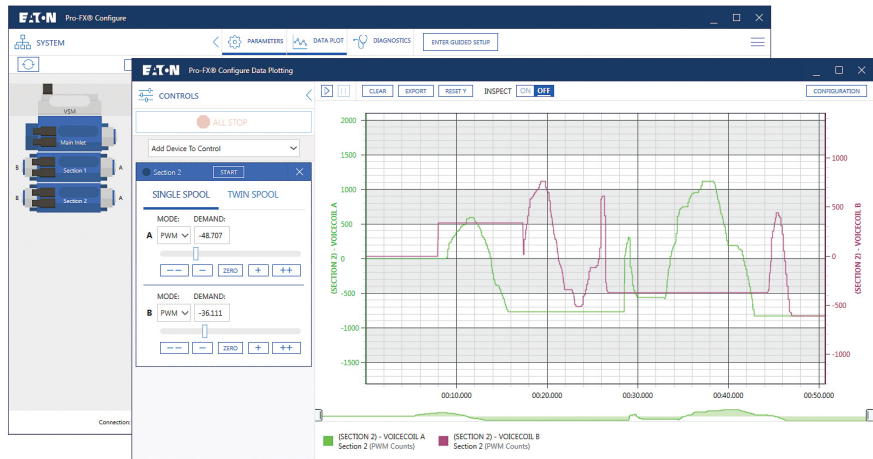
Pro-FX<sup>®</sup> Configure can be downloaded from the PowerSource<sup>®</sup> Application. at <http://www.eatonpowersource.com/tools/software-downloads/>

## Supported CAN cards

- Pro-FX<sup>®</sup> Configure 1.0:   Softing USB  
                                  Softing CANPro USB  
                                  Value CAN
- Pro-FX<sup>®</sup> Configure 2.0:   Softing USB  
                                  Softing CANPro USB  
                                  All Kvaser CAN cards

## PC requirements

- Operating system: Windows 7, 8 or 8.1  
Processor: 1 GHz  
RAM: 512 MB  
Disk space (minimum): 4.6 GB  
Minimum screen resolution: 1366x768



# Hydraulic Fluid Recommendations

## Introduction

Oil in hydraulic systems performs the dual function of lubrication and transmission of power. It is a vital element in a hydraulic system, and careful selection should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components, especially hydraulic pumps and motors.

Generally, oil selected for use with pumps and motors is acceptable for use with valves. Critical servo valves may need special consideration.

When selecting oil for use in an industrial hydraulic system, be sure the oil:

- Contains the necessary additives to ensure excellent anti-wear characteristics
- Has proper viscosity to maintain adequate sealing and lubrication at the expected operating temperature of the hydraulic system
- Includes rust and oxidation inhibitors for satisfactory system operation

## Types of hydraulic fluids

Hydraulic fluids are classified by the type of base stock used. Some fluids are further classified by fluid formulation and performance.

### Anti-wear hydraulic fluids

For general hydraulic service, Eaton recommends the use of mineral base anti-wear (AW) hydraulic oils meeting Eaton specification E-FDGN-TB002-E.

Eaton requests that fluid suppliers test newly developed lubricants on Eaton 35VQ25A high pressure vane pump, according to Eaton ATS-373 test procedure, ASTM D

6973 test method and meet other requirements of the Eaton specification E-FDGN-TB002-E. Lubricants meeting the Eaton specification are considered good quality anti-wear hydraulic fluids that can be used with Eaton components at maximum allowable operating conditions. They offer superior protection against pump wear and long service life.

### Crank case oils

Automotive-type crankcase oils with American Petroleum Institute (API) letter designation SE, SF, SG, SH or higher per SAE J183 classes of oils are recommended for hydraulic service. The "detergent" additive tends to hold water in a tight emulsion and prevents separation of water.

Automotive type crankcase oils generally exhibit less shear stability, which can result in higher loss of viscosity during service life.

Multiple-viscosity, industrial grade hydraulic fluids with better shear stability will provide improved viscosity control. Other mineral oil based lubricants commonly used in hydraulic systems are automatic transmission fluids (ATFs) and universal tractor transmission oils (UTTOs).

### Synthetic hydrocarbon

Synthetic hydrocarbon base stocks, such as polyalphaolefins (PAOs), are also used to formulate AW hydraulic fluids, crankcase oils, ATFs and UTTOs.

### Synthetic hydrocarbon

Synthetic hydrocarbon base stocks, such as polyalphaolefins (PAOs), are also used to formulate AW hydraulic fluids, crankcase oils, ATFs and UTTOs.

### Environmentally friendly hydraulic fluids

Eco-friendly characteristics is becoming a critical need, and a number of biodegradable hydraulic fluids are being used more and more in environmentally sensitive areas.

Biodegradable hydraulic fluids are generally classified as vegetable oil based (HETG), synthetic ester (HEES), polyalkylene glycol (HEPG) and polyalphaolefin (HEPR). In addition, special water glycol hydraulic fluids are used in applications in which water miscibility is necessary, along with biodegradable properties.

### Fire-resistant hydraulic fluids

Fire-resistant fluids are classified as water containing fluids or synthetic anhydrous fluids. Water acts as the fire retarding agent in water containing fluids. The chemical structure of synthetic anhydrous fluids provides fire resistance.

Many applications that are prone to fire hazard, such as steel mills, foundries, die casting, mines, etc., require the use of fire resistant hydraulic fluid for improved fire safety. Fire resistant fluids may not be fireproof, but they have better fire resistance compared to mineral oil.

The alternative fluids are recommended when specific properties, such as fire resistance, biodegradability etc., are necessary for the application. Keep in mind that alternative fluids may differ from AW petroleum fluids in properties such as pressure viscosity coefficient, specific gravity, lubricity etc. Hence certain pumps / motors may need to be de-rated, some can be operated under full ratings and others are not rated. Be sure to confirm

product ratings with the specific fluid in the intended application.

### Viscosity

Viscosity is the measure of a selection of hydraulic fluid with a specific viscosity range should be based on the needs of the system, limitations of critical components, or proper performance of specific types of units. At system startup and during operation, Eaton recommends maintaining the fluid's maximum and minimum viscosity ranges (see chart). Very high viscosities at startup temperatures can cause noise and cavitation damage to pumps.

Continuous operation at moderately high viscosities will tend to hold air in suspension in the fluid, as well as generate higher operating temperatures. This can cause noise, early failure of pumps and motors and erosion of valves. Low viscosities result in decreased system efficiency and impairment of dynamic lubrication, causing wear.

It is important to choose the proper fluid viscosity for your particular system in order to achieve the startup viscosity and running viscosity range (see chart) over the entire temperature range

# Hydraulic Fluid Recommendations

encountered. Confirm with your fluid supplier that the fluid viscosity will not be less than the minimum recommended at the maximum fluid temperature of your application.

A number of anti-wear hydraulic fluids containing polymeric thickeners (Viscosity Index Improvers [VII]) are available for use in low temperature applications. Temporary or permanent viscosity loss of some of these fluids at operating temperature may adversely affect the life and performance of components. Before using polymer containing fluids, check the extent of viscosity loss (shear stability) to avoid hydraulic service below the recommended minimum viscosity. A fluid with good shear stability is recommended for low temperature applications.

Multi-grade engine oils, ATFs, UTTOs etc., also contain VIIs, and viscosity loss will be encountered during use.

## Cleanliness

Fluid cleanliness is extremely important in hydraulic systems. More than 70% of all failures are caused by contamination, which can reduce hydraulic system efficiency up to 20% before system malfunction may be recognized. Different hydraulic components require different cleanliness

levels. The cleanliness of a hydraulic system is dictated by the cleanliness requirement of the most stringent component in the system. OEMs and distributors should provide their customers with cleanliness requirements for Eaton hydraulic components used in their system designs. Refer to Eaton product catalogs for specific cleanliness requirements of individual components.

## Fluid maintenance

The condition of a fluid has a direct bearing on the performance and reliability of the system. Maintaining proper fluid viscosity, cleanliness level, water content, and additive level is essential for excellent hydraulic system performance. In order to maintain a healthy fluid, Eaton recommends performing periodic checks on the condition of the fluid.

## System design considerations

When designing a hydraulic system, the specific gravity of the hydraulic fluid needs to be taken into consideration. If the specific gravity of the fluid is higher than that of mineral oil, be sure the reservoir fluid level is adequately above the pump inlet to meet the recommended inlet operating condition of minimum 1.0 bar absolute pressure at the pump inlet.

## Filters

Proper filter type and size, which vary depending on the type of fluid used in a system, are essential for healthy system function. The primary types of filter materials are paper, cellulose, synthetic fiber, and metal.

Filter media, adhesive, and seals must be compatible with the fluid used in the system. To lengthen fluid change out intervals, special absorbent filter media may be used to remove moisture and acids from phosphate esters.

## Seals/elastomers

Select seal/elastomer materials that are suitable for the application, minimum and maximum operating temperature, and compatibility with the type of fluid used in the hydraulic system. The effect of hydraulic fluid on a particular elastomer depends on the constituents of the fluid, temperature range, and level of contaminants.

## Replacing hydraulic fluid

Although sometimes valid, arbitrary hydraulic fluid change-outs can result in wasting good fluid and unnecessary machine downtime.

A regularly scheduled oil analysis program is recommended to determine when fluid should be replaced. The program

should include inspection of the fluid's color, odor, water content, solid contaminants, wear metals, additive elements, and oxidation products. Clean the system thoroughly and flush with fresh, new fluid to avoid any contamination with the previous fluid/lubricant. Replace all seals and filters with new, compatible parts. Mixing two different fluids in the same system is not recommended.

Contact your Eaton representative with questions concerning hydraulic fluid recommendations.

# Appendix

## Random vibration profile

Break-point Frequency	PSD (G <sup>2</sup> /Hz)	PSD (m <sup>2</sup> /s <sup>3</sup> )	Grms
10	0.52	0.1	*
20	0.375	0.5	2.09
30	0.375	0.5	1.94
70	0.35	0.5	3.80
150	0.06	0.5	3.43
1000	0.06	0.5	7.14
2000	0.01	0.5	5.02
2500	0.001	0.5	1.37

## Power consumption

Device	Power Consumption (Watts)
VSM or VSE	20
PV/CV - Idle	3.5
PV/CV - Active	9

## Calculating power consumption

This calculation must be done for each VSM or VSE in the system. PV/CV's corresponds to those connected to the VSM or VSE in question.

Power Calculation:  $20W + (\# \text{ Idle PV/CV's} * 3.5W) + (\# \text{ Active PV/CV's} * 9W)$

## Notes

1. VSM or VSE was designed assuming PV/CV load will not exceed 95 watts. Load to the VSM or VSE should not exceed 115watts (95W for PV/CV and 20W for VSM or VSE).
2. Choose wire gage properly to ensure that voltage at VSM or VSE does not drop below 9.5V during normal operation.





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