*e*RCM Express™

Product Manual

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eRCM Express™

Unit

Installation

eRCM Express units are mounted into a Unit Control Panel (UCP), typically via a DIN-rail mount.

The eRCM Express unit then needs connected to power and communications.

Please reference your mCore SDR Operations Manual for full hardware installation directions, including wiring, power, electrical, shielding, restrictions, and cabling.

- Your package includes a standard power cable.

- Please reference your Monico mCore SDR Manual for directions on connecting an Ethernet cable. Your package includes a standard Ethernet cable.

eRCM Express™

Hardware &

Communications

Please reference your mCore SDR Operations Manual for full hardware and full communications specifications and support.

While other protocols may be supported based on your purchase, the base protocol for eRCM Express is Modbus communications. When Modbus is used:

- eRCM Express is a Modbus slave,
- Ethernet/IP protocol available Q414,
- Use Function 16 to write to Modbus Registers, and
- Use Function 03 to read from Modbus Registers.

For **Modbus over IP**, only read a Maximum of **100** Registers at a time. Reading more registers than the maximum will usually cause the Modbus protocol to stop responding. If that happens, close the communications link, set your code to read fewer registers, and then reopen the communications link.

MODBUS Application Protocol Specification V1.1a Modbus-IDA
June 4, 2004 http://www.Modbus-IDA.org Page 15 of 51

6.3 03 (0x03) Read Holding Registers
This function code is used to read the contents of a contiguous block of holding registers in a remote device. The Request PDU specifies the starting register address and the number of registers. In the PDU Registers are addressed starting at zero. Therefore registers numbered 1-16 are addressed as 0-15.

The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

Request

Function code	1 Byte	**0x03**
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	1 to 125 (0x7D)

Response

Function code	1 Byte	**0x03**
Byte count	1 Byte	2 x **N***
Register value	**N*** x 2 Bytes	

***N** = Quantity of Registers

Error

Error code	1 Byte	**0x83**
Exception code	1 Byte	01 or 02 or 03 or 04

Here is an example of a request to read registers 108 – 110:

Request		**Response**	
Field Name	*(Hex)*	*Field Name*	*(Hex)*
Function	**03**	Function	**03**
Starting Address Hi	**00**	Byte Count	**06**
Starting Address Lo	**6B**	Register value Hi (108)	**02**
No. of Registers Hi	**00**	Register value Lo (108)	**2B**
No. of Registers Lo	**03**	Register value Hi (109)	**00**
		Register value Lo (109)	**00**
		Register value Hi (110)	**00**
		Register value Lo (110)	**64**

The contents of register 108 are shown as the two byte values of 02 2B hex, or 555 decimal. The contents of registers 109–110 are 00 00 and 00 64 hex, or 0 and 100 decimal, respectively.

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Use of a

Gateway Device

If using a gateway device between your PLC and your eRCM Express unit, such as a ProSoft® card or a Red Lion® device to provide Modbus protocol, then keep in mind that depending on how you program those devices, there may be a latency period between the data calculated via eRCM Express and the data readable from those devices.

- You may need to wait a bit longer before reading data from the gateway device to give it time to populate itself with the most recent data calculated.
- If latency excessive, review PLC's Modbus features, or select a faster protocol.

Special Registers:

ForceCondMonitoringCalcs, ForceLivePressures and ForceERCMExpressCalculations

- After a value of one (1) is written from the gateway to the eRCM Express for any one of the above three special registers, then the gateway needs to reset that value back to a zero (0) within its internal memory.
    - The eRCM Express unit resets these write registers from 1's back to 0's after action is taken based on the particular register being changed to a 1. However, these values are not typically "read" back into the gateway, and hence if not cleared in the gateway's memory, then the 1's will persist and will continue to be pushed back into the eRCM Express, effectively reinitiating the events, again and again.

Example:

- If PLC is connected directly with eRCM Express, and a value of 1 is pushed into the eRCM Express for ForceERCMExpressCalculations, then eRCM Express forces a recalculation of internal compressor model and sets this value back to 0. Thereafter, **only** if the PLC pushes another 1 value into the ForceERCMExpressCalculations register would calculations be redone.
- However, if PLC is connected indirectly via a gateway device, the same 1 is pushed into the gateway (and the gateway then pushes a copy of it into the eRCM Express). The eRCM Express calculates the results and clears its internal register (ForceERCMExpressCalculations) back to 0 but the gateway likely retains its original 1 value, which then it re-pushes back into the eRCM Express on its next write cycle causing the issue.
    - Thus, after the gateway writes values to the eRCM Express, then the gateway needs to clear (reset to 0) those three special registers within its own memory structure.

eRCM Express™

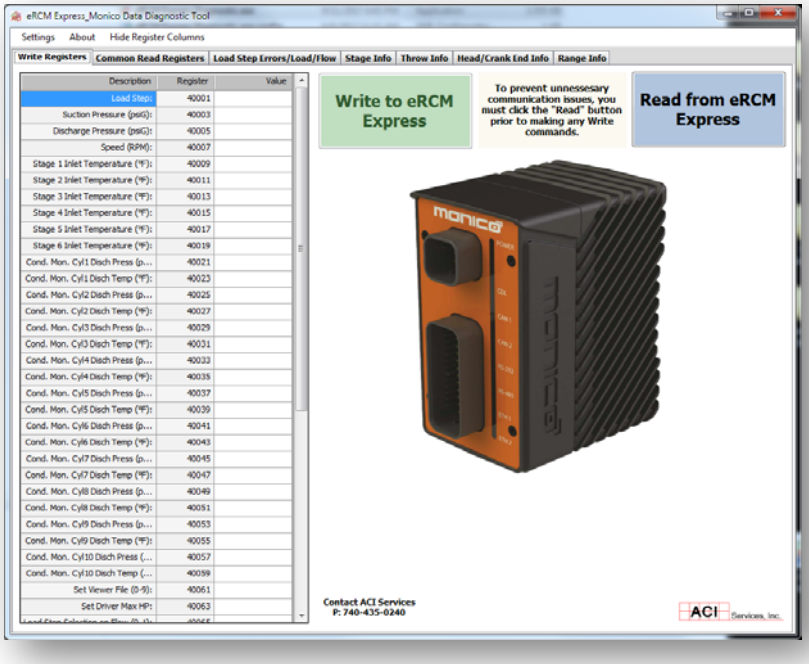
Software

Diagnostics

The latest version of the eRCM Express Diagnostic Software can be downloaded from the ACI Services, Inc. website.

With your eRCM Express unit set up (powered on, and with an active Ethernet communications line), run the eRCM Diagnostic Software on your Windows®-based PC connected to the eRCM Express unit.

Select the mCore SDR w/ eRCM Express item.



Now, enter write values via inputs in the *Write Registers* tab – remember to set the last item to a "1" to force an update, then click the **Write to eRCM Express** button. If the unit is connected and communicating correctly, all appropriate registers on the remaining tabs will be populated with calculated and returned values.

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eRCM Express™

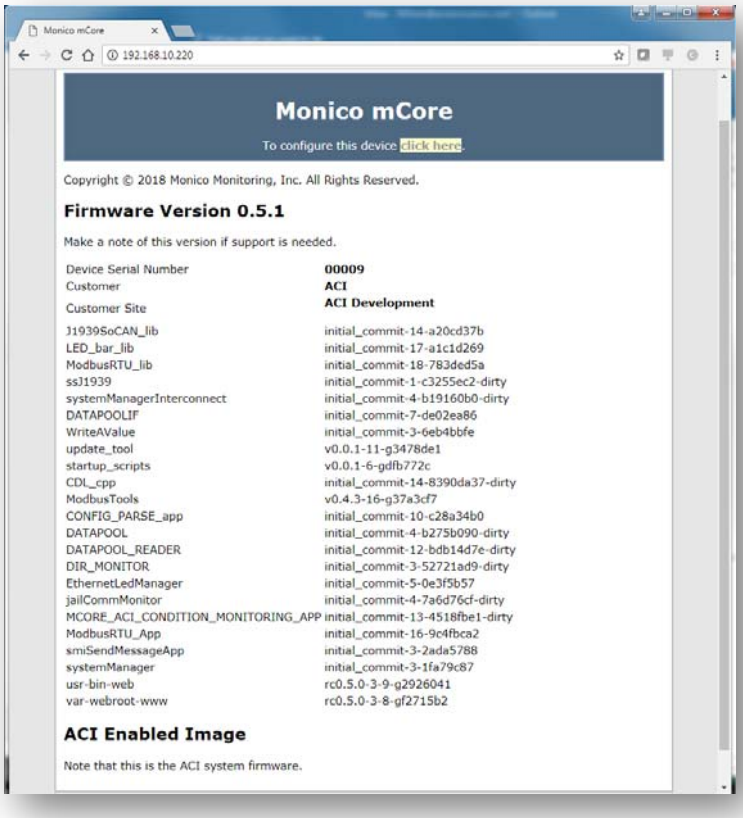
Uploading

Modeling Files

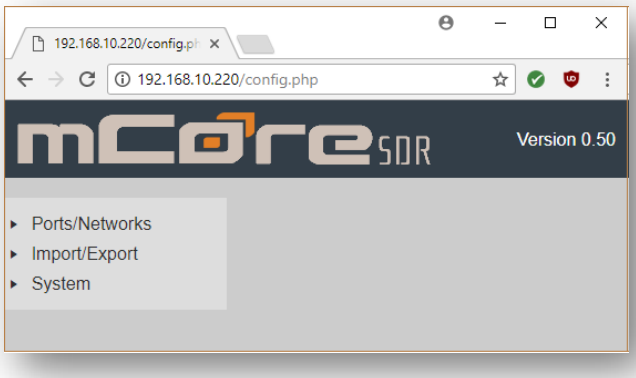
Steps to Install a New eRCM Viewer™ File(s)

1) Make sure you have the desired eRCM Viewer files (*.rvf) available for this eRCM Express.
   a. Models should reflect correct compressor hardware, gas composition, unit staging, unloading devices, operating ranges, and unloading steps.

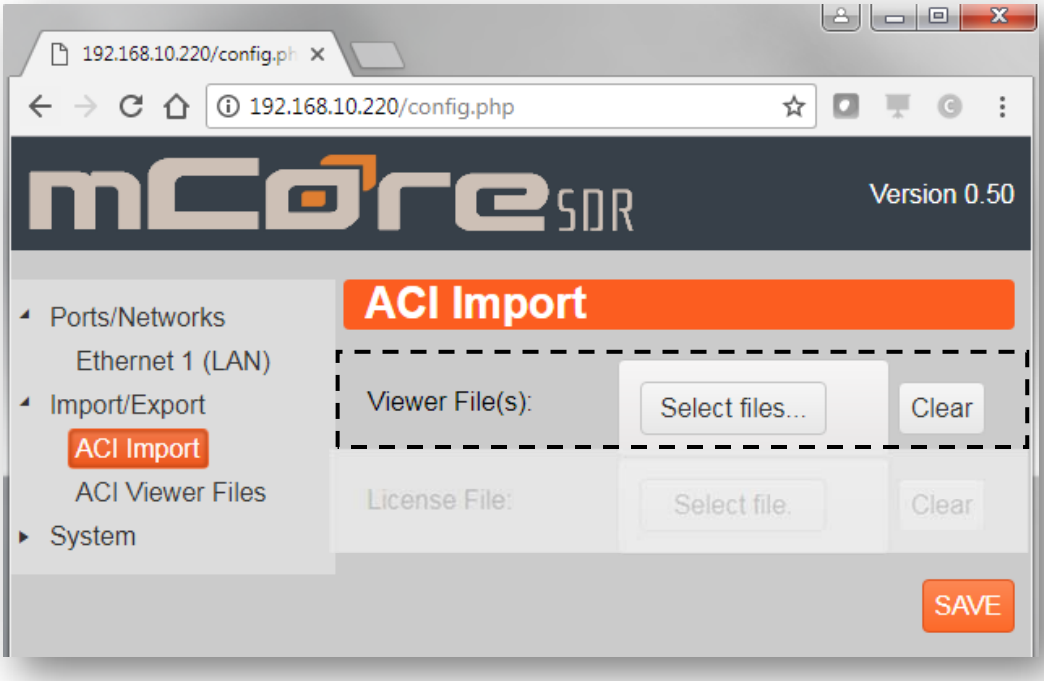
2) Connect your PC to the mCore unit – and enter 192.168.10.220 (or user-set IP number) as the address. You should be presented with the main mCore screen:



Then, after selecting the "click here" link, the following page will appear:



3) From this page, select **Import/Export** menu, then select ACI Import to view:

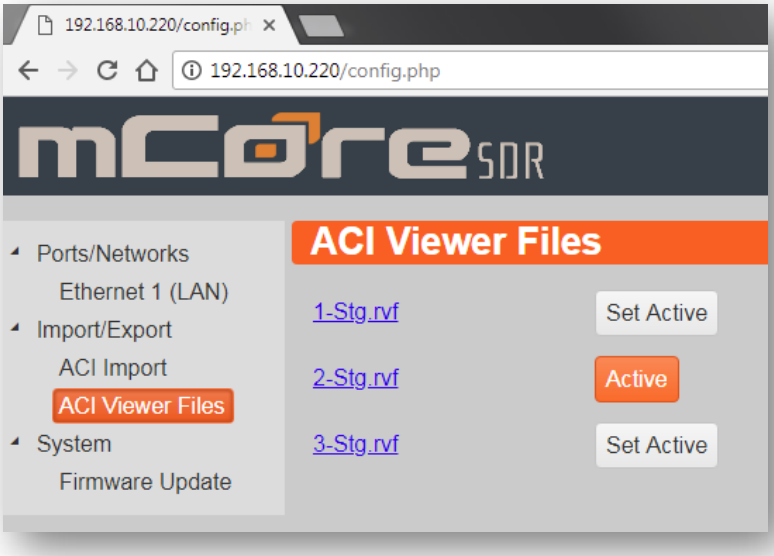


4) To clear the unit of any previous eRCM Viewer models, click the **Clear** button.

5) To specify new files to load onto the eRCM Express, select the **Select files…** button.

6) When ready, select the **SAVE** button -- this action adds new files, and/or overwrites existing files.

7) To view the list of modeling files currently in the eRCM Express, and/or to set the active file to use on startup, select **ACI Viewer Files** menu.



8) You can download a copy of the file from the eRCM Express to your PC by clicking on that file's filename link.

9) You can set one file to be the default modeling file to load during startup of the eRCM Express. To do this, select the **Set Active** button next to that filename. Its button will change to **Active**.

eRCM Express™

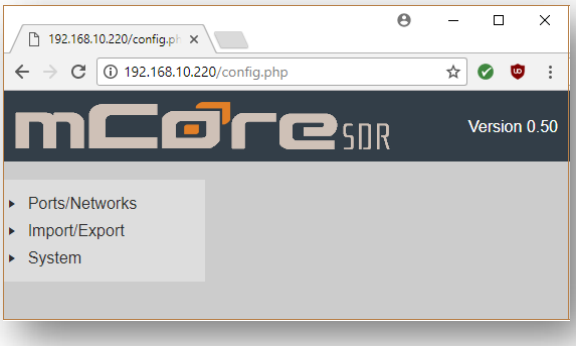
Uploading a License File

Steps to Upload a New eRCM Express License File

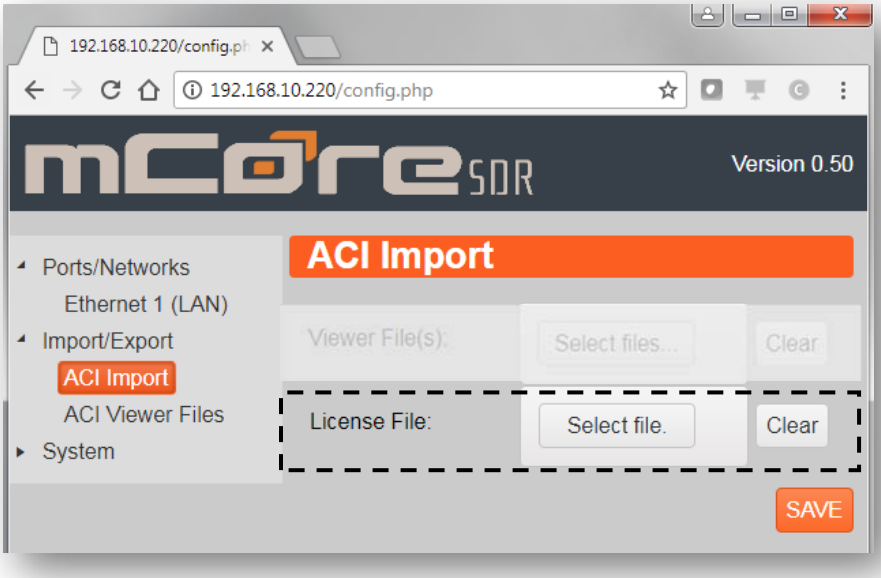
Most End-users will never need to do this.

1) All units that are shipped with either a valid eRCM Condition Monitoring license file, or a valid eRCM Express license file.
    a. **<u>However</u>**, if a device is upgraded from a Condition Monitoring unit to a full eRCM Express unit, then a new license file will need to be uploaded to access all eRCM Express features.
    b. To accomplish this, after purchase of an upgrade license, a license file will be sent to you (e.g. emailed). This license file is unique for each hardware unit and cannot be used on other mCore units. Thus, make sure it is installed on the appropriate unit.

2) Connect PC to the mCore unit – and enter 192.168.10.220 (or user-set IP number) as the address. You should be presented with the main mCore screen then elect to configure device:



3) From this page, select **Import/Export** menu, then select ACI:



4) Select the **Select file.** button to browse to the location on local drive where the provided eRCM Express (or eRCM Condition Monitoring) file is located.

5) When ready, select the **SAVE** button -- this action adds a new license file, or overwrites an existing license file.
   - To remove the current license file, then select the **Clear** button.
     - ***In general, end-users should <u>not</u> remove license files unless requested by Tech Support.***

eRCM Express™

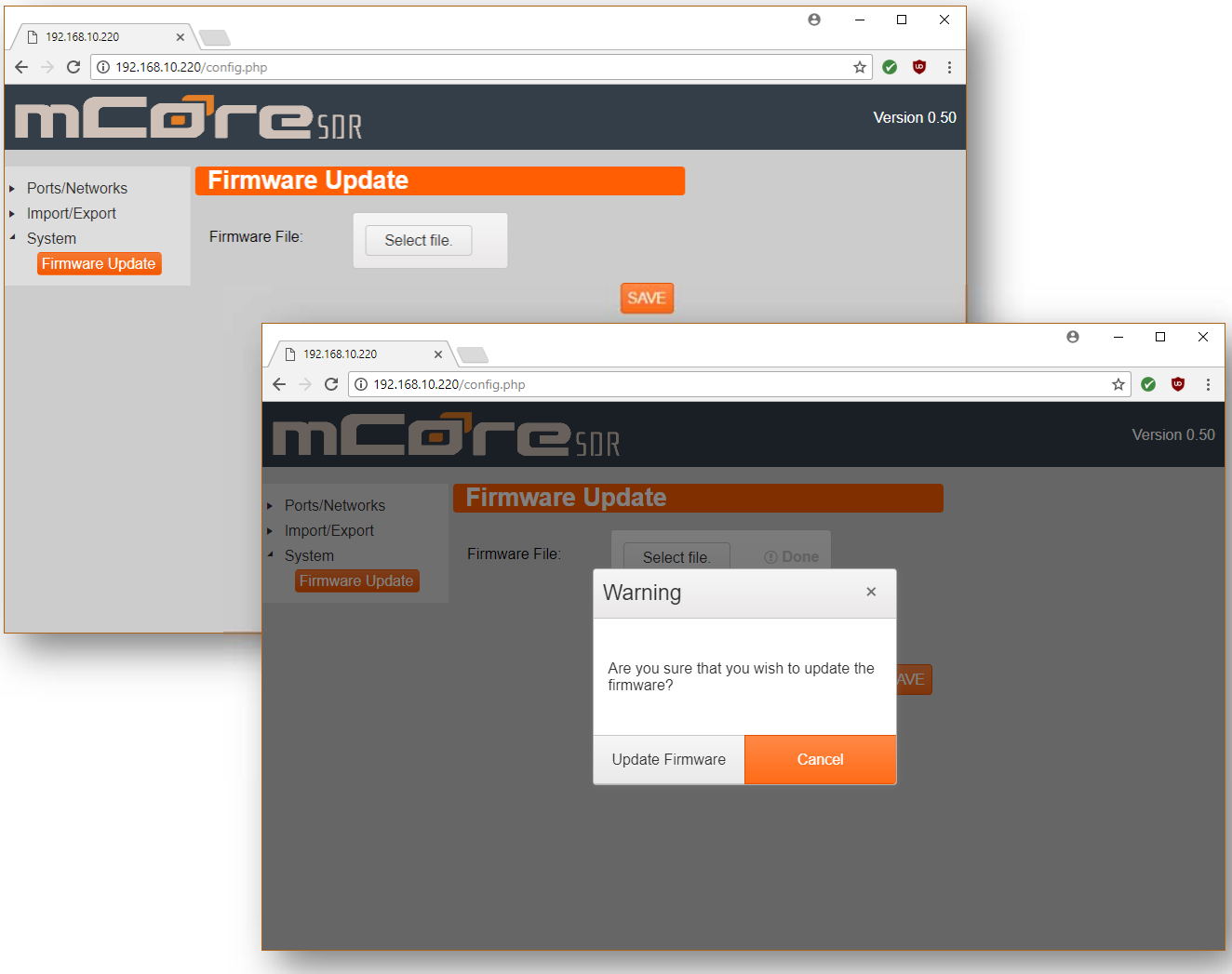
Updating Unit

Firmware

Steps to Install New eRCM Express Software

When available, Monico will provide appropriate Firmware update/upgrade files.

With the correct Firmware update/upgrade file(s) downloaded to a PC, follow the Firmware Update process as described in your mCore SDR Operations Manual.



<u>It is recommend that all eRCM Viewer model(s) are re-installed for this unit after any firmware updates/upgrades are finished.</u>

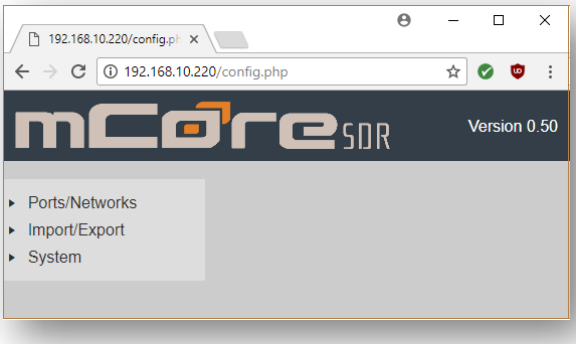
eRCM Express™

Changing LAN

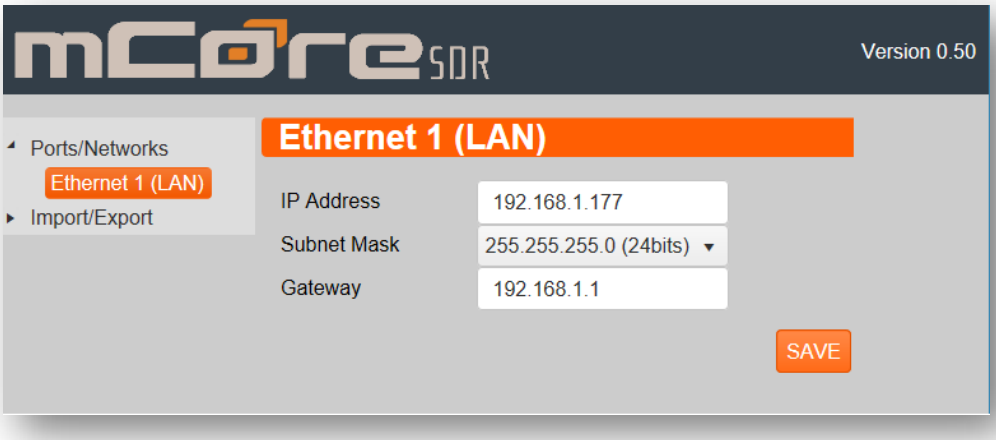
Settings

Steps to Change IP Settings for eRCM Express

1) Connect PC to the mCore unit – and enter 192.168.10.220 (or user-set IP number) as the address. You should be presented with the main mCore screen after electing to configure device:



2) Now select Ports/Networks, and then select the appropriate LAN – typically **Ethernet 1 (LAN)**.



3) Enter a new IP, subnet mask, and Gateway numbers and then select **Save**.

4) **<u>Note</u>**: The IP number for Ethernet 2 (LAN) is hard set by Monico. This static IP number is 192.168.3.3 and cannot be changed via user settings. However, it can be set prior to unit shipping. If so, it has been set to: ____ . ____ . ____ . ____

5) **<u>Note</u>**: If Ethernet 1 (LAN) is inadvertently set to the wrong IP number, or that IP number has been forgotten, then connect to Ethernet 2 (LAN) to view/change the IP number for Ethernet 1 (LAN).

eRCM Express™

General Process

1. When the PLC starts, if there is more than one potential eRCM Viewer model within the eRCM Express, then your PLC needs to make sure that it loads in the correct eRCM Viewer model.
   i. If there is only one (1) eRCM Viewer model, then this step can be skipped.
   ii. Otherwise, the best option is to have the eRCM Viewer files enumerated from 1 up to 9, and then identify which file to load via the **SetViewerFile** (REG#40101) item.

2. Next, if you have access to the Discharge Header Pressure (the discharge pressure the compressor will compress to **after** the bypass valve is closed) then you can identify the best safe load step to configure the unit to before closing the bypass valve (to prevent rod load and/or pin non-reversal issues during Start Up). This is done by using the ***CheckSafeStartup*** (REG#40107) and the ***SafeLoadStepStartup*** (REG#40329) registers.

3. If not set by the PLC, the eRCM Express will use the default values assigned to each of the following when the eRCM Viewer model was created. If you prefer different values, set them now.
   i. **MinLoadFlowPercChange** (%): Usually 2%. REG#40325.
   ii. **MaxLoadPercChange** (%): Usually in the 15-20% range. Set lower if engine cannot handle large step changes in load, set higher if engine can handle larger step changes in load and those changes are needed in areas of the operating map. REG#40327.
   iii. **LSSelectionMode**: 0=Load (default), 1=Flow. In general, Flow is usually the better choice when trying to control a process; however, most end-users tend to control a reciprocating compressor by unit load (not individual unit flow). REG#40105.

4. If desired for one of your HMI screens, read the **Ranges** for key items and set them in the PLC. These do not change until a new eRCM Model is loaded, so this set of registers does not need to be continually read. REG#s 43605 through 43647.

5. Read the following set of items, and store in PLC. These do not change until a new eRCM Model is loaded, so this set of registers does not need to be continually read.
   i. REG#40331, AuxLoad (HP)
   ii. REG#40333, BHPMax (HP)
   iii. REG#40337, Elevation (ft)
   iv. REG#40339, AtmPress (psiA)

v. REG#40341, NumCyls (#)
vi. REG#40343, NumLSs (#)
vii. REG#40345, NumStgs (#)
viii. REG#40347, NumThrws (#)
ix. REG#40349, OEM_ID (#)
x. REG#40353, MaxDischF (degF)
xi. REG#40355, RelHumid (%)

6. After the compressor and driver have warmed up, and you are ready to close the Bypass Valve, then set the compressor's load step to:
   i. The load step identified in Item #2, **<u>or</u>**
   ii. The load step Operations has identified to use when starting a unit.

7. Close the Bypass Valve

8. When the Bypass Valve is fully closed, then the unit is Online.
   i. At this point, your eRCM Express now can provide useful compressor performance and safety data that you can use to properly control your online compressor.

9. WHEN UNIT IS ONLINE: **<u>(Main Loop)</u>**
   i. Set the Current Load Step in eRCM Express via **CurrLS** (REG#40001).
   ii. From your sensor, read inlet pressure (Stage #1 Suction Pressure **PsG**) and inlet temperature (Stage #1 Suction Temperature, **Ts1F**), the last stage's discharge pressure (Discharge Pressure, **PdG**), and the suction temperature to each stage after the 1st stage **Ts2F..Ts6F**, and the current operating speed **CurrSpeed**.
   iii. Pass this information to eRCM Express via:
      i. **PsG** (REG#40003),
      ii. **PdG** (REG#40005),
      iii. **CurrSpeed** (REG#40007),
      iv. **Ts1F** (REG#40277), and as needed
         1. **Ts2F..Ts6F** (REG#40009.. REG#40019).
   iv. Set the Maximum Torque Limit (%) **TorqSP** (REG#40109). Typically this is 100%.
   v. Force an eRCM Express calculation by putting the value of 1 into **ForceERCMExpressCalculations** (REG#40273).
      i. Usually all calculations take less than 10 ms.

vi. Do not try to retrieve any performance data back from the eRCM Express until the value in **IsKernelBusy** (REG#40275) goes to zero (0). This item changes to one (1) when eRCM Express starts the compressor calculations and changes back to a zero (0) when those calculations are complete. This happens very fast (less than 10 ms for most calls).

vii. When **IsKernelBusy** is zero (0), then read the following items:

i. eRCMExpressWatchdogPulse (REG#40277)
ii. NextLoadStepUp (REG#40279)
iii. NextLoadStepDown (REG#40281)
iv. NextLSUpPercentChange (REG#40283)
v. NextLSDownPercentChange (REG#40285)
vi. MinSpeedCurrentLS (REG#40287)
vii. MaxSpeedCurrentLS (REG#40289)
viii. MinSuctPressureCurrentLS (REG#40291)
ix. MaxSuctPressureCurrentLS (REG#40293)
x. FindOptimalLoadStep (REG#40295)
xi. CurrentTorque (REG#40297)
xii. IsentropicEfficiency (REG#40299)
xiii. Fuel Rate (REG#40301)

ITEMS TO REVIEW, AND ACTIONS TO TAKE IF NEEDED:

1. **<u>Shut Downs:</u>**
   a. Communication Issues:
      i. If Modbus errors exist for more than 1 second, or if more than five (5) consecutive errors occur, then Shut Down.
      ii. If WatchdogPulse does not change after setting items when forcing a new calculation and waiting long enough for calculations to finish, then Shut Down.
   b. No safe Load Steps:
      i. If NextLoadStepUp = -1 AND NextLoadStepDown = -1 AND FindOptimalLoadStep = -1 then Shut Down.
2. **<u>Adjustments to PLC Setpoints:</u>**
   a. Set the PLC's Min Allowed Speed to MinSpeedCurrentLS
   b. Set the PLC's Max Allowed Speed to MaxSpeedCurrentLS

c. Set the PLC's Min Allowed Suction Pressure to MinSuctPressureCurrentLS
d. Set the PLC's Max Allowed Suction Pressure to MaxSuctPressureCurrentLS

3. **<u>Controls:</u>**
   a. If there is an active call for More Load (or more Flow), PLC to change loading (sample given here, actual order determined by Automation and Control programmers):
      i. If Recycle Valve not closed, start to Close Recycle, then
      ii. If available, Unpinch Suction Throttle (up to MaxSuctPressureCurrentLS), then
      iii. If not at Max Allowed Speed, Increase Speed, then
      iv. If NextLoadStepUp ≠ -1, change load step to NextLoadStepUp.
   b. If there is an active call for Less Load (or less Flow), PLC to change loading (sample given here, actual order determined by Automation and Control programmers):
      i. If not at Min Allowed Speed, Decrease Speed, then
      ii. If NextLoadStepDown ≠ -1, change load step to NextLoadStepDown.
      iii. If available, Pinch Suction Throttle (down to MinSuctPressureCurrentLS), then
      iv. Start to Close Recycle Valve.

xiv. Read in ErrorArray (REGs#40445 to 40443+NumLSs*2)
xv. Read in LoadArray (REGs#40645 to 40643+NumLSs*2)
xvi. Read in FlowArray (REGs#40845 to 40843+NumLSs*2)
   1. Display data from above three arrays on one HMI screen to show operators which load steps are valid, and the potential flow rates those load steps can deliver and their associated required loads. Ideal to highlight current Load Step, as well as the Next Load Step Up and Next Load Step Down, when available.
xvii. Read in StageArray (REGs#41045 to 41043+NumStgs*60)
   1. Display data on HMI
xviii. If/when you want key Throw Data displayed on HMI screen, then:
   1. Read in ThrowArray (REGs#41405 to 41403+NumThrws*60)
      a. Display data on HMI

xix. If/when you want key Cylinder Data displayed on HMI screen, then:
    1. Read in HECylinderInfo (REGs#42005 to 42003 + NumCylinders*80)
        a. Display data on HMI

xx. If/when you want key Cylinder Data displayed on HMI screen, then:
    1. Read in CECylinderInfo (REGs#42805 to 42803 + NumCylinders*80)
        a. Display data on HMI

viii. Go back to Item #9 (WHEN UNIT IS ONLINE section).

eRCM Express™

Pseudo Code

Examples

Read/Write Pseudo Code Examples

Sending Data to eRCM Express™:

```
Modbus.Data(1)  = 1     // Current Hardware Load Step
Modbus.Data(2)  = 206.5 // Current Suction Pressure (psiG) into First Stage
Modbus.Data(3)  = 318.9 // Current Discharge Header Pressure (psiG) out of Last Stage
Modbus.Data(4)  = 1158  // Unit's Speed (RPM)
Modbus.Data(5)  = 74.5  // First Stage Suction Gas Temperature (degF)
Modbus.Data(6)  = 128.2 // Second  Stage Suction Gas Temperature (degF), when required

Modbus.NumberOfValues = 6   // 6 is the number of input values (1 Value = two 16-bit regs)
Modbus.Address = 40001      // 40001 is the starting address for the input values
Modbus.WriteData()          // Write new input values to the Modbus registers.
```

Force eRCM Express™ to Recalculate New Compressor Performance:

```
Modbus.Data(1)  = 1         // "1" is flag to recalculate
Modbus.NumberOfValues = 1   // 1 is the number of input values (1 Value = two 16-bit regs)
Modbus.Address = 40273      // 40273 is the address for ForceERCMExpressCalculations
Modbus.WriteData()          // Write value to the Modbus register.
```

Waiting for eRCM Express™ to Complete Calculations:

```
DIM eRCMExpressCount as Integer
Modbus.NumberOfDataValues = 1
Modbus.Address = 40275  // The address of the "IsKernelBusy" register.
                        // Will return false (0) when eRCM Express has completed
                        // all of its performance and safety calculations.
                        // This usually takes less than 10 ms.
eRCMExpressCount = 0
DO
  Sleep 20                // Sleep 20 ms
  Modbus.ReadData()       // Read data in the "IsKernelBusy" register.
  If Modbus.Data(1) = 0 Then Exit DO     // If 0, then calculations are now complete.
  eRCMExpressCount = eRCMExpressCount + 1
LOOP UNTIL eRCMExpressCount > 10         // Prevent Infinite Loop

IF eRCMExpressCount > 10 THEN
  MSG "CRITICAL ISSUE: eRCM Express Unit does not appear to be returning data."
  // NOTE: If a Gateway device in between eRCM Express and your PLC, then you may need
  // to wait longer for updates to happen.
ELSE
  …Now proceed with reading in eRCM Express data…
END IF
```

Reading Data from eRCM Express™:

```
  DIM NextLoadStepUp as Double
  …
  DIM LoadStepBHPs(23) As Double

  Modbus.NumberOfDataValues = 1
  Modbus.Address = 40275  // The address of the "IsKernelBusy" register.
                          // Will return false (0) when eRCM Express has completed
                          // all of its performance and safety calculations.
                          // This usually takes less than 10 ms.
  Modbus.ReadData()               // Read data in the "IsKernelBusy" register.
  If Modbus.Data(1) = 0 Then      // If 0, then calculations are now complete.
         // Do the following to read specific items:
         Modbus.NumberOfDataValues = 13 (1 Value = two 16-bit registers)
         Modbus.Address = 40277      // Start of a block of data
         Modbus.ReadData()
         eRCMExpressWatchdogPulse  = Modbus.Data(1)
         NextLoadStepUp            = Modbus.Data(2)
         NextLoadStepDown          = Modbus.Data(3)
         NextLSUpPercentChange     = Modbus.Data(4)
         NextLSDownPercentChange   = Modbus.Data(5)
         MinSpeedCurrentLS         = Modbus.Data(6)
         MaxSpeedCurrentLS         = Modbus.Data(7)
         MinSuctPressureCurrentLS  = Modbus.Data(8)
         MaxSuctPressureCurrentLS  = Modbus.Data(9)
         FindOptimalLoadStep       = Modbus.Data(10)
         CurrentTorque             = Modbus.Data(11)
         IsentropicEfficiency      = Modbus.Data(12)
         FuelRate                  = Modbus.Data(13)

         // Do the following to read an array of values at once:
         // Example: Get the load for load steps 1 through 23
         Modbus.NumberOfDataValues = 23
         Modbus.Address = 40645 // Modbus address for start of LoadArray values (Load Step 1)
         Modbus.ReadData()
         LoadStepBHPs(1) = Modbus.Data(1)    // Load for Load Step 1  (Address 40645)
         LoadStepBHPs(2) = Modbus.Data(2)    // Load for Load Step 2  (Address 40647)
         LoadStepBHPs(3) = Modbus.Data(3)    // Load for Load Step 3  (Address 40649)
         LoadStepBHPs(4) = Modbus.Data(4)    // Load for Load Step 4  (Address 40651)
…
         LoadStepBHPs(23) = Modbus.Data(23)  // Load for Load Step 23 (Address 40689)
…
  END IF
```

eRCM Express™

Using Select

Features

1. **How do I make sure that the correct eRCM Viewer model is loaded into eRCM Express?**
    a. If there is only one (1) eRCM Viewer model used, then it is loaded by default and no check is usually needed.
    b. If there are multiple unit models loaded into eRCM Express (or you want to verify for security), then you need to run some code during start up to set and check:
        i. A default model will load in when eRCM Express starts. This may, or may not, be the desired model.
        ii. If there are multiple eRCM Viewer models on the eRCM Express, then the PLC needs to identify which one it wants to load (and then verify it afterwards). This is done via employing the **File Identification Method**, which is describe in more detail under the "Change Default File via PLC" section.
    c. Best to wait at least 500 ms after loading a new file before checking it.
    d. Also, see section on "Methodology to Verify Correct Model is Loaded"

2. **How can I verify that eRCM Express is working, via code?**
    a. Check the value in the **eRCMExpressWatchdogPulse** register. If this value changes after your next call to **ChangeOpCondition** then eRCM Express is working as intended. The returned value will always be an integer from 0 to 6 million, and should never be the same as the previous number.

3. **How do I know if the eRCM Express is working and returning correct values in the unit's registers?**
    a. Install ACI's eRCM Express Diagnostics & Communications Software (available free from the ACI website). Install that software onto your Windows PC, set up an Ethernet connection from your PC to the eRCM Express unit and run the software. Reference that software's Help for more information about how to effectively use it.

4. **What do I change to make eRCM Express select load steps using larger (or smaller) increments?**
    a. Set the percent of desired change (for either load or flow) in the register **MinLoadFlowPercChange**. Subsequent changes to conditions will lead to determination of **NextLoadStepUp** and **NextLoadStepDown** based on the new percent change value.

5. **How do I force eRCM Express to select load steps based on flow, or on power?**

a. To base load step selection on Load, set **LSSelectionMode** to 0. To base load step selection on Flow, set **LSSelectionMode** to 1.
b. In general, selection on Flow lends itself better to process control. However, most users prefer to control reciprocating compressor strictly on load.

6. **How do I determine which load step to set the unit to before closing the bypass valve during Start Up?**
   a. To determine which load step to set the hardware configuration to, before closing the bypass valve, set the current operating conditions (**PsG**, **PdG**, **CurrSpeed**, **Ts1F**,…), and then set **CheckSafeStartup** to 1 and then force a calculation by setting **ForceERCMExpressCalculations** to 1. When calculations are complete the **SafeLoadStepStartup** register contains the load step to use.
      i. **NOTE**: For this option to be useful, during this mode you must send the discharge line pressure (***after the bypass valve***), and not a cylinder discharge pressure (before the bypass valve), when you set the current operating conditions.

7. **What does *MaxLoadPercChange* do?**
   a. The register value in **MaxLoadPercChange** is used to prevent eRCM Express from selecting a load step that could result in undesirable consequences to the engine. A significant and sudden change in load (an increase or a decrease) can lead to problems with engines (over-speeding or under-speeding or surging). For many engines, the maximum load change limit is about a 15% change in load, whilst some may go as high as 25-30%. For electric motors, the limit may be higher since electric flows react faster than fuel flows.

8. **What's the logic behind selecting Next Load Step Up (and Down)?**
   a. Based on the torque (or flow) of the Current Load Step, eRCM Express identifies which load steps are at least ***MinLoadFlowPercChange*** percentage points higher (or lower for Next Load Step Down) but no more than ***MaxLoadPercChange*** percentage points away. Then, the closest safe load steps to that limit are selected. If more than one load step is reasonable, then the load step with the best Load per Unit Flow ratio is selected (as it is the most efficient).

9. **I'm not matching the correct bits set in the registers defined by ErrorArray().**

a. The bits set in the ErrorArray register items can only be properly identified when their two (2) 16-bit Modbus Integer registers are correctly interpreted as a 32-bit Long.

- **i.** The most common issues are:
  1. The two (2) 16-bit Modbus registers are juxtaposed. If this is the issue, swap the two 16-bit register locations when creating the 32-bit Long.
  2. Data is read as a Floating Point instead of an Integer.

10. How do I use the Live Pressures feature? *(Future Option)*

a. This feature allows you to obtain performance based on actual suction and discharge pressures to each stage. Thus, you must have appropriate sensors when using this feature. The general approach is to obtain compressor performance (by sending eRCM Express the values for Current Load Step, Current Speed, Current Suction Gas Temperatures to each stage, and the first stage's Suction Gas Pressure and the last stage's Discharge Gas Pressure) based on the current point.

b. However, performance will be based on predicted interstage pressures. Hence, the PLC should continually check to make sure actual interstage pressures are within acceptable deviations from predicted interstage pressures – usually the pressures need checked after waiting 10-30 seconds after any load step change – to allow compressor system to stabilize.

   i. If there is a higher than desired discrepancy between predicted interstage pressures and actual interstage pressures, then something is not quite right (model is incorrect, load steps are not aligned between PLC and model, sensor data is incorrect, a load control device is not working correctly, etc.).

   ii. When that happens, to keep unit safe until above items can be corrected, keep unit in its current load step at its current speed, and use the Live Pressures method to check for unit safety. If any issues are indicated via ErrorArray(CurrentLoadStep), then Shut Down.

Check back with ACI for future firmware updates that support this option.

eRCM Express™

Change Current

Modeling File

via PLC

File Identification Method:

At times, you may need to have multiple eRCM Viewer files loaded and ready on your eRCM Express unit. Examples may include:

- One model for 1-stage injection, one model for 2-stage injection, and a third model for 1-stage withdrawal.
- One model for process gas, and another model for purge gas.
- One model for unit with no valve spacers, one for all suction valve spacers in, one for all valve spacers in, and one model for suction valves pulled.

When the need arises to have multiple model, then the eRCM Viewer files must be specifically identified with a leading digit of "1" through "9" in their filenames. Thus, if a file is named "Unit4_1-Stage_GMV6.rvf" this method will not work, but if the file is named "**1**Unit4_1-Stage_GMV6.rvf" then it will.

- Thus, updating files to the eRCM Express must be handled so that the files have leading digits of "1" through "9" in their filenames.
- **Warning**: Filenames with the same leading digit will lead to confusion. Thus, do not use filenames like "**1**-0_Unit-12.rvf" and "**1**-1_Unit-12b.rvf" as both have the same leading digit "**1**". ***NOTE: Avoid spaces and special characters in filenames.***
- Sample filenames that Can and Cannot be used with this Method:

Filenames that can be Used	Filenames that cannot be Used
1Unit7-Ariel_2-Stg.rvf	Unit7-Ariel 2-Stg.rvf
8Superior_MH6_1-Stage.rvf	Superior MH6 Single Stage.rvf
2.rvf	Rev2.rvf
6_GE-DS_Service1-CNG.rvf	GE DS Service1-CNG.rvf

- To select the file to use, simply set the register ***SetViewerFile*** (Register Address 40101) to the special ID number of that file, from "1" to "9".
    - Best to wait at least 500 ms after loading a new file before checking it.

- Sample Pseudo Code for this Method

```
' Load in file "4 CooperBessermer 2-Stg.rvf" into eRCM Express
Modbus.NumberOfDataValues = 1
Modbus.Address = 40101
Modbus.Data(1) = 4     // Load in eRCM Model that starts with the digit "4"
Modbus.WriteData()
Pause 500 ms
' Correct model should now be loaded in eRCM Express.
' Check it (NumStages, NumThrows, NumLSs, etc. to make sure it is correct)
```

eRCM Express™

Miscellaneous

Notes

Relax eRCM Limits to Station Limits:

When implementing a compressor model in a Unit Control Panel environment, set certain limits within the model so that those limits do not trigger an invalid condition before the PLC would trigger an invalid condition.

- Example 1: If the PLC alarms at a discharge temperature of 300 °F and shut downs at a discharge temperature of 325 °F, then the maximum allowed discharge temperature in the eRCM Viewer model should be 325 °F, and not 300 °F.
- Example 2: If the unit is allowed to go to 40% torque, then make sure that the Min Allowed Torque setting in the eRCM Express is 40% or lower.

The goal is to not have the eRCM Express trigger unnecessary shut downs by indicating all load steps as unsafe, when in fact they may still be within the PLC's limits.

Using Compressor to Pack a Discharge Line:

If the unit needs to pack a discharge pipe that has fallen below its normal minimum pressure, then ensure that the following limits are set in the eRCM Viewer model being used in the eRCM Express unit:

- Minimum Compression Ratio = 1.00
- Minimum Discharge Pressure = Minimum Suction Pressure

Running Unit at Low Torque:

If the unit needs to occasionally run in low torque conditions, then make sure that in the eRCM Viewer model being used in the eRCM Express unit:

- Minimum Torque = A number from from 0% to 40%.
  Typical Default for Motors is 25%, and Typical Default for Engines is 60%.

Running Unit when Discharge Pressure is Less Than Suction Pressure:

If the unit needs to occasionally run when the discharge header pressure is less than the suction header pressure, then:

1) Make sure that this is okayed by the OEM. Operations in blow-through can potentially significantly degrade the life of compressor valves.
2) eRCM Express is not useful for determining unit safety under these conditions (blow-through). So, if that mode is ok with the OEM, then to keep eRCM Express from indicating operating issues, simply set the Discharge Pressure equal to the Suction Pressure. Thus, if Ps=390 psiG, and Pd=350 psiG, when sending data to eRCM Express, simply send 390 for Ps, and 390 for Pd.

eRCM Express™

Modbus Registers

Commonly Used Lists

*e*RCM™ Express Quick Write List

eRCM Express is a Modbus slave. The following are appropriate registry listings. Ethernet/IP protocol available Q414.

- Use Function 16 to write Operating Point Inputs to Modbus Registers 40001- 40273 (see registry below).
- Use Function 03 to read back CPASA Outputs from Modbus Registers 40275- 43653 (see registry below).
- ***NOTE**: All registers (read & write) are 32-bit Floating Point type, **except** for those between 40445 and 40643 inclusive which form the ErrorArray() and all of these represent 32-bit Integer type. Modbus usually reads items as 16-bit registers, so make sure the two 16-bit registers are transferred correctly to create the final 32-bit Floating Point number and/or the 32-bit Integer number.*
- ***NOTE**: To prevent shut downs during operations due to speed spikes, if a value sent as speed (CurrSpeed) is less than minimum allowed then the minimum allowed speed is used instead and no errors are generated. Also, if value sent as speed (CurrSpeed) is greater than the maximum allowed then the maximum allowed speed is used instead and no again errors are generated.*

*e*RCM™ Express Quick WRITE List

Most Commonly Used Items

Function	Register	Units	Operating Point inputs	Common Tag Name
16	40001	#	Unit's Current Load Step	CurrLS
16	40003	psiG	Suction Pressure into Stage-1	Ps_psiG
16	40005	psiG	Discharge Pressure out of Last Stage	Pd_psiG
16	40007	rpm	Operating Speed	CurrSpeed
16	40009	°F	1st Stage Suction Gas Temperature	Ts1_F
16	40011	°F	2nd Stage Suction Gas Temperature	Ts2_F
16	40013	°F	3rd Stage Suction Gas Temperature	Ts3_F
16	40015	°F	4th Stage Suction Gas Temperature	Ts4_F
16	40101	#	Set which eRCM Viewer Model to use	SetViewerFile
16	40273	#	Set to "1" to force eRCM Express Recalculation	ForceERCMExpressCalculations

Less Commonly Used Items

Function	Register	Units	Operating Point inputs	Common Tag Name
16	40103	HP	Set Driver's Max Power, only if dynamically changes	SetDriverMaxHP
16	40105	#	**0 = Select Load Steps based on power (default)**; 1 = select Load Steps based on flow	LSSelectionMode
16	40107	#	0 = Normal Operations; 1 = Request Safe Start Up Load Step	CheckSafeStartUp
16	40109	%	Set Current Max Allowed Torque, **usually set to 100**(%)	TorqSP
16	40111	0	**Always set to 0**	LSMode
16	40113	°F	Set to current Ambient Temperature **only** if engine ambient rated	TambF
16	40115	0/1	**0 = Normal Mode;** 1 = Allow Load Steps with non-critical issues	IgnoreNonCriticalErrors
16	40117	%	Set Min % of Rated Power (or percent of current max flow) to consider when determining Next Step Up and Next Step Down	MinLoadFlowPercChange
16	40119	%	Set Max % of Rated Power to consider when determining Next Step Up and Next Step Down	MaxLoadPercChange

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*e*RCM™ Express Quick READ List

Fnct	Register	Units	Description/Use	Common Tag Name
03	40275	-	Returns a one (1) that indicates if the eRCM Express computational engine is currently busy doing calculations. A zero (0) indicates that it is safe to poll for information as calculations are complete.	KrnlBusy
03	40277	#	Returns a unique number (from 0 to 6 million) that changes every time new operating conditions are processed by eRCM Express. Helps PLC determine if the full loop of communication/calculations is being implemented.	WDPulse
03	40279	#	Relative to Current Operating Conditions and Current Load Step, this register contains the Next Safe Up (increased load). If there is no safe load step with higher load, then a -1 is returned.	NextLSUp
03	40281	#	Relative to Current Operating Conditions and Current Load Step, this register contains the Next Safe Down (decreased load). If there is no safe load step with lower load, then a -1 is returned.	NextLSDown
03	40283	%	Returns the percent of load change from Current Load Step to Next Step Up, relative to maximum allowed load at the current speed. If there is no safe load step up, then this function returns 999999 as the percent change.	NSU_Perc
03	40285	%	Returns the percent of load change from Current Load Step to Next Step Down, relative to maximum allowed load at the current speed. If there is no safe load step down, then this function returns 999999 as the percent change.	NSD_Perc
03	40287	Rpm	For the Current Load Step, returns the lowest speed (rpm) for which unit can be adjusted without causing safety issues.	MinRPM
03	40289	Rpm	For the Current Load Step, returns the highest speed (rpm) for which unit can be adjusted without causing safety issues.	MaxRPM
03	40291	psiG	For the Current Load Step, returns the lowest suction pressure (psiG) for which unit can be adjusted without causing safety issues.	MinPs1
03	40293	psiG	For the Current Load Step, returns the highest suction pressure (psiG) for which unit can be adjusted without causing safety issues.	MaxPs1
03	40295	#	Returns the ideal Load Step to which to load, to fully load the unit. This is for reference only as the unit's/PLC's goals may not always be to maximize unit's load. Additionally, this registers returns a value of -1 if all load step are invalid.	OptimalLS
03	40297	%	For the Current Load Step, returns the Current Torque (%).	CurrTorq
03	40299	%	Returns unit's efficiency (measure of how efficient the compressor is at current operating point).	IsenEff
03	40301	scf/hr	Returns fuel rate based on current load and current speed.	FuelRate

***NOTE*: If NextLSUp = -1 and NextLSDown = -1 and OptimalLS = -1, then there are NO SAFE LOAD STEPS, and hence unit should Shut Down.**

Fnct	Register	Units	Description/Use	Common Tag Name
03	40325	%	Returns Minimum Percent of Load (or flow if LSSonFlow=1) to consider when looking for Next Step Up or Down.	GetMinLoadFlowPercChange
03	40327	%	Returns the Maximum Percent of load to consider when looking for Next Step Up or Down.	GetMaxLoadPercChange
03	40329	#	**Use CheckSafeStartup to force a calculation of this item. If value= -1, then there is no safe load step for which to start unit.**	LStoSetforSU
03	40331	HP	Returns the Auxiliary Load plus any Frame Friction Load (BHP).	AuxLoad
03	40333	HP	Returns the driver's maximum load (BHP).	BHPMax
03	40335	HP	Returns current Max Allowed Load (BHP) based on current torque setting, rated load, current speed and T-Amb (if emissions engaged).	BHPMax at TorqSP
03	40337	ft	Returns the elevation (ft) used for compressor modeling.	Elevation
03	40339	psiA	Returns Atmospheric Pressure (psiA).	AtmPress
03	40341	#	Returns number of cylinders modeled in the current model.	NumCyls
03	40343	#	Returns number of load step defined in the mode.	NumLSs
03	40345	#	Returns number of compression stages used in the current model.	NumStgs
03	40347	#	Returns number of throws modeled in the current model.	NumThrws
03	40349	#	Returns ID Number indicating the OEM of the frame/unit being modeled. (See eRCM Software for list of OEM IDs.)	OEM ID
03	40351	#	Returns mechanical efficiency used to convert indicated horsepower to brake horsepower.	MechEff
03	40353	DegF	Returns the average Maximum Discharge Temperature (degF) allowed for all modeled cylinders on the unit.	MaxDischF
03	40355	%	Returns Relative Percent Humidity of Initial Inlet Gas being modeled, from 0 to 100 (%).	RelHumid

Fnct	Register	Units	Description/Use	Common Tag Name
3	40445…	#, INT	Only read as many as needed. Then look at bits of 32-bit Integers for specific errors encountered per load step.	ErrorArray()
3	40643	#, INT	Any items with a non-zero value indicates that that load step is unsafe to use!	

Fnct	Register	Units	Description/Use	Common Tag Name
03	40645…	HP	**Only read as many as needed. Then look at values of 32-bit Floats to see if any are too high (overloaded) or too low (under loaded) for your driver. If any, drop them.**	LoadArray()
03	40843	HP	**Overloading and underloading are driver (engine/motor) related issues rather than compressor-related issues. Thus, if you want to limit load more than via the Max and Min allowed torque settings, then you'll need to handle these via the PLC.**	

Fnct	Register	Units	Description/Use	Common Tag Name
03	40845…	MMscfd	**Only read as many as needed.**	FlowArray()
03	41043	MMscfd		

Fnct	Register	Units	**Description/Use --** Add 60 for each additional stage.	Common Tag Name
03	41059	#	Stage Compression Ratio	StageArray()
03	41065	HP	Stage Load	
03	41067	MMscfd	Stage Flow	
03	41089	DegR	Cylinder Discharge Temperature (°R, not °F)	

Fnct	Register	Units	**Description/Use --** Add 60 for each additional throw.	Common Tag Name
03	**41405**	**%**	Gas Rod Loads – Compression (Most Low-speed units)	**ThrowArray()**
03	**41407**	**%**	Gas Rod Loads – Tension (Most Low-speed units)	
03	**41413**	**%**	Net Rod Loads – Compression (High-speed units)	
03	**41415**	**%**	Net Rod Loads – Tension (High-speed units)	
03	**41443**	**#**	Degrees of Pin Reversal in Compression	
03	**41445**	**#**	Degrees of Pin Reversal in Tension	

Fnct	Register	Units	**Description/Use --** Add 80 for each additional cylinder.	Common Tag Name
03	**42011**	**DegF**	Cylinder End Estimated Discharge Temperature	**CylHEArray(), and for**
03	**42017**	**%**	Suction Volumetric Efficiency	**CylCEArray() – add 800**
03	**42033**	**HP**	Cylinder End Load	**to register numbers**

Fnct	Register	Units	Description/Use	Common Tag Name
03	**43605**	**psiG**	Min Allowed Suction Pressure	**Ranges**
03	**43607**	**psiG**	Max Allowed Suction Pressure	
03	**43609**	**psiG**	Min Allowed Discharge Pressure	
03	**43611**	**psiG**	Max Allowed Discharge Pressure	
03	**43613**	**rpm**	Min Allowed Speed	
03	**43615**	**rpm**	Max Allowed Speed	
03	**43617**	**%**	Min Allowed Torque	
03	**43619**	**%**	Max Allowed Torque	
03	**43621**	**DegF**	Min Allowed Ambient Temperature	
03	**43623**	**DegF**	Max Allowed Ambient Temperature	
03	**43625**	**DegF**	Min Allowed Stage-1 Gas Temperature	
03	**43627**	**DegF**	Max Allowed Stage-1 Gas Temperature	
03	**43629**	**DegF**	Min Allowed Stage-2 Gas Temperature	
03	**43631**	**DegF**	Max Allowed Stage-2 Gas Temperature	
03	**43633**	**DegF**	Min Allowed Stage-3 Gas Temperature	
03	**43635**	**DegF**	Max Allowed Stage-3 Gas Temperature	
03	**43637**	**DegF**	Min Allowed Stage-4 Gas Temperature	
03	**43639**	**DegF**	Max Allowed Stage-4 Gas Temperature	
03	**43641**	**DegF**	Min Allowed Stage-5 Gas Temperature	
03	**43643**	**DegF**	Max Allowed Stage-5 Gas Temperature	
03	**43645**	**DegF**	Min Allowed Stage-6 Gas Temperature	
03	**43647**	**DegF**	Max Allowed Stage-6 Gas Temperature	

eRCM Express™

Modbus Registers

Full Write/Read List

List of All Active Writes:

NAME	ADDRESS	Item Description	Notes
CurrLS	40001	Current Load Step	These are the basic values the control panel needs to send to eRCM Express.
PsG	40003	Inlet Pressure (psig) into the **first** stage	
PdG	40005	Discharge Pressure (psig) out of the **last** stage	
CurrSpeed	40007	Operating Speed (rpm)	
Ts1F	40009	Suction Gas Temperature into the **first** stage	
Ts2F	40011	Suction Gas Temperature into the **second** stage (after any cooler)	
Ts3F	40013	Suction Gas Temperature into the **third** stage (after any cooler)	
Ts4F	40015	Suction Gas Temperature into the **fourth** stage (after any cooler)	
Ts5F	40017	Suction Gas Temperature into the **fifth** stage (after any cooler)	
Ts6F	40019	Suction Gas Temperature into the **sixth** stage (after any cooler)	
Cyl1_Pd	40021	These item are used for Condition Monitoring. The indicated pressures (psig) are to be taken at **each** cylinder's discharge flange, and the indicated temperature (F) are to be taken at **each** cylinder's discharge flange.	These items are only used when doing Condition Monitoring.
Cyl1_Td	40023		
Cyl2_Pd	40025		
Cyl2_Td	40027		
Cyl3_Pd	40029		
Cyl3_Td	40031	If discharge flange pressures and discharge flange temperatures are not available, then the Condition Monitoring results will be of limited value or even incorrect.	
Cyl4_Pd	40033		
Cyl4_Td	40035		
Cyl5_Pd	40037		
Cyl5_Td	40039	Suction pressures to each cylinder can be the stage pressure leading to that cylinder.	
Cyl6_Pd	40041		
Cyl6_Td	40043		
Cyl7_Pd	40045	Suction temperatures to each cylinder can the stage temperature (after and	
Cyl7_Td	40047		
Cyl8_Pd	40049		
Cyl8_Td	40051		
Cyl9_Pd	40053		
Cyl9_Td	40055		
Cyl10_Pd	40057		
Cyl10_Td	40059		
Stage 1 Ps	40061	Actual pressures (psiG) from sensors (average per cylinder as needed).	These items are only used when doing Live Pressures.
Stage 1 Pd	40063		
Stage 2 Pd	40065		
Stage 3 Pd	40067		
Stage 4 Pd	40069		
Stage 5 Pd	40071		
Stage 6 Pd	40073		
SetViewerFile	40101	-1=> Load Next File. 1..9 => Specific Filename starting with that digit.	Not needed if only **one** modeling file being used.
SetDriverMaxHP	40103	Allows for overriding model's Max Driver Load (HP)	
LSSectionMode	40105	0=Force model to load unit on Load. 1=Force to load on Flow.	
CheckSafeStartUp	40107	0=Normal Operations. 1=Request Safe Start Up Load Step	Check SafeLoadStepStartup for the load step to use.
TorqSP	40109	Set Current Max Allowed Torque (percent)	Cannot be set higher than upper limit defined in model.
LSMode	40111	Always set to 0.	
TambF	40113	Set to current Ambient Temperature (degF)	Used only for models derating engine on Ambient Temps.
IgnoreNonCriticalErrors	40115	0=Normal Mode. 1=Allow Load Steps with non-critical issues.	Used during starting or stopping. Limit use to < 240 secs.
MinLoadFlowPercChange	40117	Set Min % of load (or flow) to consider for Next Step Up or Down.	Values from 0.5 to 10 (%) allowed.
MaxLoadPercChange	40119	Set Max % of load to consider for Next Step Up or Down.	Values from 2 to 80 (%) allowed.
ForceCondMonitoringCalcs	40121	Set to 1 after setting all required items for Condition Monitoring.	Resets back to 0 after calculations are complete.
ForceLivePressures	40123	Set to 1 after setting all required items for Live Pressures.	Resets back to 0 after calculations are complete.
SS12	40141	SetSideStreamVolumeINOUT1-2: Set the side stream volume (MMscfd).	These items are only used when Side Streams are present.
SS23	40143	SetSideStreamVolumeINOUT2-3: Set the side stream volume (MMscfd).	
SS34	40145	SetSideStreamVolumeINOUT3-4: Set the side stream volume (MMscfd).	Use a negative number for side streams OUT, and a positive number for side streams IN, between stages.
SS45	40147	SetSideStreamVolumeINOUT4-5: Set the side stream volume (MMscfd).	
SS56	40149	SetSideStreamVolumeINOUT5-6: Set the side stream volume (MMscfd).	
SSDegFin12	40151	SetSideStreamIN_Temperature1-2 (degF)	Set the temperature of the side stream IN between the indicated stages.
SSDegFin23	40153	SetSideStreamIN_Temperature2-3 (degF)	
SSDegFin34	40155	SetSideStreamIN_Temperature3-4 (degF)	
SSDegFin45	40157	SetSideStreamIN_Temperature4-5 (degF)	
SSDegFin56	40159	SetSideStreamIN_Temperature5-6 (degF)	
ForceERCMExpressCalculations	40273	Force eRCM Express to run performance and safety calculations.	Set this to a "1" to force recalculations of all perf. Items.

List of All Active Reads:

COMMON CONTROL ITEMS:

NAME	ADDRESS	Long Name	Description
KrnlBusy	40275	IsKernelBusy	Returns a one (1) that indicates if the eRCM Express computational engine is currently busy doing calculations. A zero (0) indicates that it is safe to poll for information as calculations are complete.
WDPulse	40277	eRCMExpressWatchdogPulse	Returns a unique number (from 0 to 6 million) that changes every time new operating conditions are processed by eRCM Express. Helps PLC determine if the full loop of communication/calculations is being implemented.
NextLSUp	40279	NextLoadStepUp	Relative to Current Operating Conditions and Current Load Step, this register contains the Next Safe Up (increased load). If there is no safe load step with higher load, then a -1 is returned.
NextLSDown	40281	NextLoadStepDown	Relative to Current Operating Conditions and Current Load Step, this register contains the Next Safe Down (decreased load). If there is no safe load step with lower load, then a -1 is returned.
NSU_Perc	40283	NextLSUpPercentChange	Returns the percent of load change from Current Load Step to Next Step Up, relative to maximum allowed load at the current speed. If there is no safe load step up, then this function returns 999999 as the percent change.
NSD_Perc	40285	NextLSDownPercentChange	Returns the percent of load change from Current Load Step to Next Step Down, relative to maximum allowed load at the current speed. If there is no safe load step down, then this function returns 999999 as the percent change.
MinRPM	40287	MinSpeedCurrentLS	For the Current Load Step, returns the lowest speed (rpm) for which unit can be adjusted without causing safety issues.
MaxRPM	40289	MaxSpeedCurrentLS	For the Current Load Step, returns the highest speed (rpm) for which unit can be adjusted without causing safety issues.
MinPs1	40291	MinSuctPressureCurrentLS	For the Current Load Step, returns the lowest suction pressure (psiG) for which unit can be adjusted without causing safety issues.
MaxPs1	40293	MaxSuctPressureCurrentLS	For the Current Load Step, returns the highest suction pressure (psiG) for which unit can be adjusted without causing safety issues.
OptimalLS	40295	FindOptimalLoadStep	Returns the ideal Load Step to which to load, to fully load the unit. This is for reference only as the unit's/PLC's goals may not always be to maximize unit's load. **Additionally, this registers returns a value of -1 if all load step are invalid.**
CurrTorq	40297	CurrentTorque	For the Current Load Step, returns the Current Torque (%).
IsenEff	40299	IsentropicEfficiency	Returns unit's efficiency (measure of how efficient the compressor is at current operating point).
FuelRate	40301	FuelRate	Returns fuel rate (scf/hr) based on current load and current speed.

GENERAL ITEMS:

NAME	ADDRESS	Description
GetMinLoadFlowPercChange	40325	Returns Minimum Percent of Load (or flow if LSSonFlow=1) to consider when looking for Next Step Up or Down.
GetMaxLoadPercChange	40327	Returns the Maximum Percent of **load** to consider when looking for Next Step Up or Down.
LStoSetforSU	40329	Use CheckSafeStartup to force a calculation of this item. If value= -1, then there are no safe load steps for which to start the unit.
AuxLoad	40331	Returns the Auxiliary Load plus any Frame Friction Load (BHP).
BHPMax	40333	Returns the driver's maximum load (BHP).
BHPMax at TorqSP	40335	Returns current Max Allowed Load (BHP) based on current torque setting, rated load, current speed and T-Amb (if emissions engaged).
Elevation	40337	Returns the elevation (ft) used for compressor modeling.
AtmPress	40339	Returns Atmospheric Pressure (psiA).
NumCyls	40341	Returns number of cylinders modeled in the current model.
NumLSs	40343	Returns number of load step defined in the mode.
NumStgs	40345	Returns number of compression stages used in the current model.
NumThrws	40347	Returns number of throws modeled in the current model.
OEM ID	40349	Returns ID Number indicating the OEM of the frame/unit being modeled. (See eRCM Software for list of OEM IDs.)
MechEff	40351	Returns mechanical efficiency used to convert indicated horsepower to brake horsepower.
MaxDischF	40353	Returns the average Maximum Discharge Temperature (degF) allowed for all modeled cylinders on the unit.
RelHumid	40355	Returns Relative Percent Humidity of Initial Inlet Gas being modeled, from 0 to 100 (%).

CONDITION MONITORING ITEMS:

NAME	ADDRESS	Description	
UnitSlip	40385	Effect of all valves (all stages and all cylinders) on the unit's flow as a whole.	
CylSlip.C01	40387	Effect of valve and ring leakage for each particular cylinder on that cylinder's effective flow rate.	
CylSlip.C02	40389		
CylSlip.C03	40391		
CylSlip.C04	40393		
CylSlip.C05	40395	Customer can develop their own limits for when results trigger need to review cylinder's valves and rings, but:	
CylSlip.C06	40397	Results < -0.08 are very bad	Results > 0.08 are very bad
CylSlip.C07	40399	Results between -0.08 and -0.04 are bad	Results between 0.04 and 0.08 are bad
CylSlip.C08	40401	Results between -0.04 and -0.02 are of some concern	Results between 0.02 and -0.04 are of some concern
CylSlip.C09	40403	**Results between -0.02 and +0.02 are normal**	
CylSlip.C10	40405		

ERROR ARRAY:

NAME	ADDRESS	NAME	ADDRESS	NAME	ADDRESS	NAME	ADDRESS
Err.LS.01	40445	Err.LS.26	40495	Err.LS.51	40545	Err.LS.76	40595
Err.LS.02	40447	Err.LS.27	40497	Err.LS.52	40547	Err.LS.77	40597
Err.LS.03	40449	Err.LS.28	40499	Err.LS.53	40549	Err.LS.78	40599
Err.LS.04	40451	Err.LS.29	40501	Err.LS.54	40551	Err.LS.79	40601
Err.LS.05	40453	Err.LS.30	40503	Err.LS.55	40553	Err.LS.80	40603
Err.LS.06	40455	Err.LS.31	40505	Err.LS.56	40555	Err.LS.81	40605
Err.LS.07	40457	Err.LS.32	40507	Err.LS.57	40557	Err.LS.82	40607
Err.LS.08	40459	Err.LS.33	40509	Err.LS.58	40559	Err.LS.83	40609
Err.LS.09	40461	Err.LS.34	40511	Err.LS.59	40561	Err.LS.84	40611
Err.LS.10	40463	Err.LS.35	40513	Err.LS.60	40563	Err.LS.85	40613
Err.LS.11	40465	Err.LS.36	40515	Err.LS.61	40565	Err.LS.86	40615
Err.LS.12	40467	Err.LS.37	40517	Err.LS.62	40567	Err.LS.87	40617
Err.LS.13	40469	Err.LS.38	40519	Err.LS.63	40569	Err.LS.88	40619
Err.LS.14	40471	Err.LS.39	40521	Err.LS.64	40571	Err.LS.89	40621
Err.LS.15	40473	Err.LS.40	40523	Err.LS.65	40573	Err.LS.90	40623
Err.LS.16	40475	Err.LS.41	40525	Err.LS.66	40575	Err.LS.91	40625
Err.LS.17	40477	Err.LS.42	40527	Err.LS.67	40577	Err.LS.92	40627
Err.LS.18	40479	Err.LS.43	40529	Err.LS.68	40579	Err.LS.93	40629
Err.LS.19	40481	Err.LS.44	40531	Err.LS.69	40581	Err.LS.94	40631
Err.LS.20	40483	Err.LS.45	40533	Err.LS.70	40583	Err.LS.95	40633
Err.LS.21	40485	Err.LS.46	40535	Err.LS.71	40585	Err.LS.96	40635
Err.LS.22	40487	Err.LS.47	40537	Err.LS.72	40587	Err.LS.97	40637
Err.LS.23	40489	Err.LS.48	40539	Err.LS.73	40589	Err.LS.98	40639
Err.LS.24	40491	Err.LS.49	40541	Err.LS.74	40591	Err.LS.99	40641
Err.LS.25	40493	Err.LS.50	40543	Err.LS.75	40593	Err.LS.100	40643

Bit Directory:

Bit 00 / Discharge Pressure Exceeded	Bit 16 / Max Pressure Differential Exceeded
Bit 01 / Discharge Temperature Exceeded	Bit 17 / Estimated Cylinder Discharge Temperatures are High
Bit 02 / Gas Rod Loads Exceeded	Bit 18 / Low Compression Ratio
Bit 03 / Net Rod Loads Exceeded	Bit 19 / High Compression Ratio
Bit 04 / Low Volumetric Efficiency	Bit 20 / Ariel Gas Rod Load Exceeded
Bit 05 / Throttling Occurred	Bit 21 / BHP per Throw Limit Exceeded
Bit 06 / Z-Factor Out Of Range	Bit 22 / Under Allowed Load
Bit 07 / Invalid Suction Pressure	*Bit 23 / Reserved*
Bit 08 / Invalid Discharge Pressure	*Bit 24 / Reserved*
Bit 09 / RESERVED (should always be 0)	*Bit 25 / Reserved*
Bit 10 / Failed Rod Reversal	*Bit 26 / Reserved*
Bit 11 / Pin Reversal Exceeded	*Bit 27 / Reserved*
Bit 12 / API618 3%-Rule Violated	*Bit 28 / Reserved*
Bit 13 / Non-obtainable Goal	*Bit 29 / Reserved*
Bit 14 / Blank Off Occurred	*Bit 30 / Reserved*
Bit 15 / Liquids May Be Forming	*Bit 31 / Reserved*

LOAD ARRAY:

NAME	ADDRESS	NAME	ADDRESS	NAME	ADDRESS	NAME	ADDRESS
Load.LS.01	40645	Load.LS.26	40695	Load.LS.51	40745	Load.LS.76	40795
Load.LS.02	40647	Load.LS.27	40697	Load.LS.52	40747	Load.LS.77	40797
Load.LS.03	40649	Load.LS.28	40699	Load.LS.53	40749	Load.LS.78	40799
Load.LS.04	40651	Load.LS.29	40701	Load.LS.54	40751	Load.LS.79	40801
Load.LS.05	40653	Load.LS.30	40703	Load.LS.55	40753	Load.LS.80	40803
Load.LS.06	40655	Load.LS.31	40705	Load.LS.56	40755	Load.LS.81	40805
Load.LS.07	40657	Load.LS.32	40707	Load.LS.57	40757	Load.LS.82	40807
Load.LS.08	40659	Load.LS.33	40709	Load.LS.58	40759	Load.LS.83	40809
Load.LS.09	40661	Load.LS.34	40711	Load.LS.59	40761	Load.LS.84	40811
Load.LS.10	40663	Load.LS.35	40713	Load.LS.60	40763	Load.LS.85	40813
Load.LS.11	40665	Load.LS.36	40715	Load.LS.61	40765	Load.LS.86	40815
Load.LS.12	40667	Load.LS.37	40717	Load.LS.62	40767	Load.LS.87	40817
Load.LS.13	40669	Load.LS.38	40719	Load.LS.63	40769	Load.LS.88	40819
Load.LS.14	40671	Load.LS.39	40721	Load.LS.64	40771	Load.LS.89	40821
Load.LS.15	40673	Load.LS.40	40723	Load.LS.65	40773	Load.LS.90	40823
Load.LS.16	40675	Load.LS.41	40725	Load.LS.66	40775	Load.LS.91	40825
Load.LS.17	40677	Load.LS.42	40727	Load.LS.67	40777	Load.LS.92	40827
Load.LS.18	40679	Load.LS.43	40729	Load.LS.68	40779	Load.LS.93	40829
Load.LS.19	40681	Load.LS.44	40731	Load.LS.69	40781	Load.LS.94	40831
Load.LS.20	40683	Load.LS.45	40733	Load.LS.70	40783	Load.LS.95	40833
Load.LS.21	40685	Load.LS.46	40735	Load.LS.71	40785	Load.LS.96	40835
Load.LS.22	40687	Load.LS.47	40737	Load.LS.72	40787	Load.LS.97	40837
Load.LS.23	40689	Load.LS.48	40739	Load.LS.73	40789	Load.LS.98	40839
Load.LS.24	40691	Load.LS.49	40741	Load.LS.74	40791	Load.LS.99	40841
Load.LS.25	40693	Load.LS.50	40743	Load.LS.75	40793	Load.LS.100	40843

FLOW ARRAY:

NAME	ADDRESS	NAME	ADDRESS	NAME	ADDRESS	NAME	ADDRESS
Flow.LS.01	40845	Flow.LS.26	40895	Flow.LS.51	40945	Flow.LS.76	40995
Flow.LS.02	40847	Flow.LS.27	40897	Flow.LS.52	40947	Flow.LS.77	40997
Flow.LS.03	40849	Flow.LS.28	40899	Flow.LS.53	40949	Flow.LS.78	40999
Flow.LS.04	40851	Flow.LS.29	40901	Flow.LS.54	40951	Flow.LS.79	41001
Flow.LS.05	40853	Flow.LS.30	40903	Flow.LS.55	40953	Flow.LS.80	41003
Flow.LS.06	40855	Flow.LS.31	40905	Flow.LS.56	40955	Flow.LS.81	41005
Flow.LS.07	40857	Flow.LS.32	40907	Flow.LS.57	40957	Flow.LS.82	41007
Flow.LS.08	40859	Flow.LS.33	40909	Flow.LS.58	40959	Flow.LS.83	41009
Flow.LS.09	40861	Flow.LS.34	40911	Flow.LS.59	40961	Flow.LS.84	41011
Flow.LS.10	40863	Flow.LS.35	40913	Flow.LS.60	40963	Flow.LS.85	41013
Flow.LS.11	40865	Flow.LS.36	40915	Flow.LS.61	40965	Flow.LS.86	41015
Flow.LS.12	40867	Flow.LS.37	40917	Flow.LS.62	40967	Flow.LS.87	41017
Flow.LS.13	40869	Flow.LS.38	40919	Flow.LS.63	40969	Flow.LS.88	41019
Flow.LS.14	40871	Flow.LS.39	40921	Flow.LS.64	40971	Flow.LS.89	41021
Flow.LS.15	40873	Flow.LS.40	40923	Flow.LS.65	40973	Flow.LS.90	41023
Flow.LS.16	40875	Flow.LS.41	40925	Flow.LS.66	40975	Flow.LS.91	41025
Flow.LS.17	40877	Flow.LS.42	40927	Flow.LS.67	40977	Flow.LS.92	41027
Flow.LS.18	40879	Flow.LS.43	40929	Flow.LS.68	40979	Flow.LS.93	41029
Flow.LS.19	40881	Flow.LS.44	40931	Flow.LS.69	40981	Flow.LS.94	41031
Flow.LS.20	40883	Flow.LS.45	40933	Flow.LS.70	40983	Flow.LS.95	41033
Flow.LS.21	40885	Flow.LS.46	40935	Flow.LS.71	40985	Flow.LS.96	41035
Flow.LS.22	40887	Flow.LS.47	40937	Flow.LS.72	40987	Flow.LS.97	41037
Flow.LS.23	40889	Flow.LS.48	40939	Flow.LS.73	40989	Flow.LS.98	41039
Flow.LS.24	40891	Flow.LS.49	40941	Flow.LS.74	40991	Flow.LS.99	41041
Flow.LS.25	40893	Flow.LS.50	40943	Flow.LS.75	40993	Flow.LS.100	41043

STAGE ARRAY:

NAME	STAGE-1	STAGE-2	STAGE-3	STAGE-4	STAGE-5	STAGE-6
Stage-Item.01	41045	41105	41165	41225	41285	41345
Stage-Item.02	41047	41107	41167	41227	41287	41347
Stage-Item.03	41049	41109	41169	41229	41289	41349
Stage-Item.04	41051	41111	41171	41231	41291	41351
Stage-Item.05	41053	41113	41173	41233	41293	41353
Stage-Item.06	41055	41115	41175	41235	41295	41355
Stage-Item.07	41057	41117	41177	41237	41297	41357
Stage-Item.08	41059	41119	41179	41239	41299	41359
Stage-Item.09	41061	41121	41181	41241	41301	41361
Stage-Item.10	41063	41123	41183	41243	41303	41363
Stage-Item.11	41065	41125	41185	41245	41305	41365
Stage-Item.12	41067	41127	41187	41247	41307	41367
Stage-Item.15	41073	41133	41193	41253	41313	41373
Stage-Item.16	41075	41135	41195	41255	41315	41375
Stage-Item.17	41077	41137	41197	41257	41317	41377
Stage-Item.21	41085	41145	41205	41265	41325	41385
Stage-Item.22	41087	41147	41207	41267	41327	41387
Stage-Item.23	41089	41149	41209	41269	41329	41389
Stage-Item.26	41095	41155	41215	41275	41335	41395

Items

Item 1: Suction Pressure at Gage (psig)
Item 2: Discharge Pressure at Gage (psig)
Item 3: Suction Temperature (°F)
Item 4: Adiabatic Discharge Temperature (°F)
Item 5: Z-Suction Compressibility Factor
Item 6: Z-Discharge Compressibility Factor
Item 7: Gas K-Value
Item 8: Compression Ratio
Item 9: Suction Pressure at Flange (psig)
Item 10: Discharge Pressure at Flange (psig)
Item 11: Load (BHP) per stage
Item 12: Flow (MMscfd) per stage
Item 13 (reserved)
Item 14: (reserved)
Item 15: Compressibility Factor at current Base Conditions
Item 16: Specific Gravity of gas being compressed via this stage
Item 17: Mole Weight of gas being compressed via this stage
Item 18: (reserved)
Item 19: (reserved)
Item 20: (reserved)
Item 21: Base Temperature for Base Conditions (°F)
Item 22: Discharge pressure reflecting pressure drops up to the cylinder flange (psiA)
Item 23: Discharge Temperature at cylinder flange (°R)
Item 24: (reserved)
Item 25: (reserved)
Item 26: Suction pressure reflecting pressure drops up to the cylinder flange (psiA)
Item 27: (reserved)
Item 28: (reserved)
Item 29: (reserved)
Item 30: (reserved)

THROW ARRAY:

NAME	Throw-1	Throw-2	Throw-3	Throw-4	Throw-5	Throw-6	Throw-7	Throw-8	Throw-9	Throw-10
Throw-Item.01	41405	41465	41525	41585	41645	41705	41765	41825	41885	41945
Throw-Item.02	41407	41467	41527	41587	41647	41707	41767	41827	41887	41947
Throw-Item.03	41409	41469	41529	41589	41649	41709	41769	41829	41889	41949
Throw-Item.04	41411	41471	41531	41591	41651	41711	41771	41831	41891	41951
Throw-Item.05	41413	41473	41533	41593	41653	41713	41773	41833	41893	41953
Throw-Item.06	41415	41475	41535	41595	41655	41715	41775	41835	41895	41955
Throw-Item.07	41417	41477	41537	41597	41657	41717	41777	41837	41897	41957
Throw-Item.11	41425	41485	41545	41605	41665	41725	41785	41845	41905	41965
Throw-Item.12	41427	41487	41547	41607	41667	41727	41787	41847	41907	41967
Throw-Item.13	41429	41489	41549	41609	41669	41729	41789	41849	41909	41969
Throw-Item.14	41431	41491	41551	41611	41671	41731	41791	41851	41911	41971
Throw-Item.15	41433	41493	41553	41613	41673	41733	41793	41853	41913	41973
Throw-Item.16	41435	41495	41555	41615	41675	41735	41795	41855	41915	41975
Throw-Item.17	41437	41497	41557	41617	41677	41737	41797	41857	41917	41977
Throw-Item.18	41439	41499	41559	41619	41679	41739	41799	41859	41919	41979
Throw-Item.19	41441	41501	41561	41621	41681	41741	41801	41861	41921	41981
Throw-Item.20	41443	41503	41563	41623	41683	41743	41803	41863	41923	41983
Throw-Item.21	41445	41505	41565	41625	41685	41745	41805	41865	41925	41985
Throw-Item.22	41447	41507	41567	41627	41687	41747	41807	41867	41927	41987
Throw-Item.23	41449	41509	41569	41629	41689	41749	41809	41869	41929	41989
Throw-Item.24	41451	41511	41571	41631	41691	41751	41811	41871	41931	41991
Throw-Item.25	41453	41513	41573	41633	41693	41753	41813	41873	41933	41993
Throw-Item.26	41455	41515	41575	41635	41695	41755	41815	41875	41935	41995
Throw-Item.27	41457	41517	41577	41637	41697	41757	41817	41877	41937	41997
Throw-Item.29	41461	41521	41581	41641	41701	41761	41821	41881	41941	42001
Throw-Item.30	41463	41523	41583	41643	41703	41763	41823	41883	41943	42003

Items Item 1: Compression Forces based on Gas Pressures at Flanges (% of Allowed Limit)
Item 2: Tension Forces based on Gas Pressures at Flanges (% of Allowed Limit)
Item 3: Compression Forces based on Internal Gas Pressures (% of Allowed Limit)
Item 4: Tension Forces based on Internal Gas Pressures (% of Allowed Limit)
Item 5: Compression Forces based on Internal Gas Pressures and Reciprocating Weights (% of Allowed Limit)
Item 6: Tension Forces based on Internal Gas Pressures and Reciprocating Weights (% of Allowed Limit)
Item 7: 1=Passed Pin Reversals, 0=Failed Pin Reversals (1 or 0)
Item 8: (reserved)
Item 9: (reserved)
Item 10: (reserved)
Item 11: Compression Forces based on Gas Pressures at Flanges (Allowed Limit, lbf)
Item 12: Tension Forces based on Gas Pressures at Flanges (Allowed Limit, lbf)
Item 13: Compression Forces based on Internal Gas Pressures (Allowed Limit, lbf)
Item 14: Tension Forces based on Internal Gas Pressures (Allowed Limit, lbf)
Item 15: Compression Forces based on Internal Gas Pressures and Reciprocating Weights (Allowed Limit, lbf)
Item 16: Tension Forces based on Internal Gas Pressures and Reciprocating Weights (Allowed Limit, lbf)
Item 17: True (-1) if a Tandem cylinder is present on this throw, otherwise False (0) is returned.
Item 18: Cylinder Number of cylinder on this throw, or the cylinder number of the Outboard Cylinder if a tandem is present. If cylinder number not found, then a 0 is returned.
Item 19: Cylinder Number of cylinder on this throw, or the cylinder number of the Inboard
Item 20: Degrees of Crank Angle in Compression. (From 0° to 360°)
Item 21: Degrees of Crank Angle in Tension.
Item 22: Reciprocating Weights used on this throw for Rod Load Inertia forces. (lbm)
Item 23: Reversal Weight used on this throw for Pin Load Inertia forces and Degrees of Pin Reversal. (lbm)
Item 24:: Gas-at-Flange Rod Load Compression forces (lbf)
Item 25: Net Rod Load Compression forces (lbf)
Item 26: Net Rod Load Tension forces (lbf)
Item 27: Gas-at-Flange Rod Load Tension forces (lbf)
Item 28: (reserved)
Item 29: Internal Gas-Only Rod Load Tension forces (lbf)
Item 30: Internal Gas-Only Rod Load Compression forces (lbf)

CYL_HE ARRAY:

NAME	CylHE-1	CylHE-2	CylHE-3	CylHE-4	CylHE-5	CylHE-6	CylHE-7	CylHE-8	CylHE-9	CylHE-10
CylHE-Item.01	42005	42085	42165	42245	42325	42405	42485	42565	42645	42725
CylHE-Item.02	42007	42087	42167	42247	42327	42407	42487	42567	42647	42727
CylHE-Item.03	42009	42089	42169	42249	42329	42409	42489	42569	42649	42729
CylHE-Item.04	42011	42091	42171	42251	42331	42411	42491	42571	42651	42731
CylHE-Item.05	42013	42093	42173	42253	42333	42413	42493	42573	42653	42733
CylHE-Item.06	42015	42095	42175	42255	42335	42415	42495	42575	42655	42735
CylHE-Item.07	42017	42097	42177	42257	42337	42417	42497	42577	42657	42737
CylHE-Item.08	42019	42099	42179	42259	42339	42419	42499	42579	42659	42739
CylHE-Item.09	42021	42101	42181	42261	42341	42421	42501	42581	42661	42741
CylHE-Item.10	42023	42103	42183	42263	42343	42423	42503	42583	42663	42743
CylHE-Item.11	42025	42105	42185	42265	42345	42425	42505	42585	42665	42745
CylHE-Item.12	42027	42107	42187	42267	42347	42427	42507	42587	42667	42747
CylHE-Item.13	42029	42109	42189	42269	42349	42429	42509	42589	42669	42749
CylHE-Item.14	42031	42111	42191	42271	42351	42431	42511	42591	42671	42751
CylHE-Item.15	42033	42113	42193	42273	42353	42433	42513	42593	42673	42753
CylHE-Item.16	42035	42115	42195	42275	42355	42435	42515	42595	42675	42755
CylHE-Item.17	42037	42117	42197	42277	42357	42437	42517	42597	42677	42757
CylHE-Item.18	42039	42119	42199	42279	42359	42439	42519	42599	42679	42759
CylHE-Item.19	42041	42121	42201	42281	42361	42441	42521	42601	42681	42761
CylHE-Item.20	42043	42123	42203	42283	42363	42443	42523	42603	42683	42763
CylHE-Item.21	42045	42125	42205	42285	42365	42445	42525	42605	42685	42765
CylHE-Item.22	42047	42127	42207	42287	42367	42447	42527	42607	42687	42767
CylHE-Item.23	42049	42129	42209	42289	42369	42449	42529	42609	42689	42769
CylHE-Item.24	42051	42131	42211	42291	42371	42451	42531	42611	42691	42771
CylHE-Item.25	42053	42133	42213	42293	42373	42453	42533	42613	42693	42773
CylHE-Item.26	42055	42135	42215	42295	42375	42455	42535	42615	42695	42775
CylHE-Item.27	42057	42137	42217	42297	42377	42457	42537	42617	42697	42777
CylHE-Item.28	42059	42139	42219	42299	42379	42459	42539	42619	42699	42779
CylHE-Item.29	42061	42141	42221	42301	42381	42461	42541	42621	42701	42781
CylHE-Item.33	42069	42149	42229	42309	42389	42469	42549	42629	42709	42789
CylHE-Item.38	42079	42159	42239	42319	42399	42479	42559	42639	42719	42799

Items	Item 1: Suction Pressure into cylinder (psig)	Item 21: Cylinder Friction (fraction)
	Item 2: Discharge Pressure out of cylinder (psig)	Item 22: Cylinder Slippage (fraction)
	Item 3: Suction temperature of gas into cylinder (°F)	Item 23: Deactivation Pressure source used (0=Suction, 1=Discharge)
	Item 4: Estimated discharge temperature of cylinder (°F)	Item 24: Cylinder MAWP (or max allowed pressure set in eRCM model) (psiG)
	Item 5: Z-Suction Compressibility Factor	Item 25: Suction Valves being Used in Active Compression Mode
	Item 6: Z-Discharge Compressibility Factor	Item 26: Discharge Valves being Used in Active Compression Mode
	Item 7: Suction Volumetric Efficiency (%)	Item 27: Suction Valves being Used in Deactivated End Mode
	Item 8: Discharge Volumetric Efficiency (%)	Item 28: Discharge Valves being Used in Deactivated End Mode
	Item 9: Fixed clearance (%) of cylinder end	Item 29: Throw Number on which this cylinder is located.
	Item 10: Effective clearance (%) of cylinder end	*Item 30: (reserved)*
	Item 11: Isentropic Efficiency (%) per end	*Item 31: (reserved)*
	Item 12: Adiabatic horsepower (BHP) used to compress gas per end	*Item 32: (reserved)*
	Item 13: Valve loss (BHP) used to move gas through valves	Item 33: Maximum allowed Discharge Temperature for this cylinder (°F)
	Item 14: Parasitic loss (BHP) used when end is deactivated	*Item 34: (reserved)*
	Item 15: Total load (BHP) used per end	*Item 35: (reserved)*
	Item 16: Flow (MMscfd) per end	*Item 36: (reserved)*
	Item 17: Which Stage of compression this cylinder serves	*Item 37: (reserved)*
	Item 18: Bore Diameter (in)	Item 38: Length of the Stroke for the VVCP on this cylinder end. (in)
	Item 19: Rod Diameter (in)	*Item 39: (reserved)*
	Item 20: End Active (1=Active, 0=Deactivated)	*Item 40: (reserved)*

CYL_CE ARRAY:

NAME	CylCE-1	CylCE-2	CylCE-3	CylCE-4	CylCE-5	CylCE-6	CylCE-7	CylCE-8	CylCE-9	CylCE-10
CylCE-Item.01	42805	42885	42965	43045	43125	43205	43285	43365	43445	43525
CylCE-Item.02	42807	42887	42967	43047	43127	43207	43287	43367	43447	43527
CylCE-Item.03	42809	42889	42969	43049	43129	43209	43289	43369	43449	43529
CylCE-Item.04	42811	42891	42971	43051	43131	43211	43291	43371	43451	43531
CylCE-Item.05	42813	42893	42973	43053	43133	43213	43293	43373	43453	43533
CylCE-Item.06	42815	42895	42975	43055	43135	43215	43295	43375	43455	43535
CylCE-Item.07	42817	42897	42977	43057	43137	43217	43297	43377	43457	43537
CylCE-Item.08	42819	42899	42979	43059	43139	43219	43299	43379	43459	43539
CylCE-Item.09	42821	42901	42981	43061	43141	43221	43301	43381	43461	43541
CylCE-Item.10	42823	42903	42983	43063	43143	43223	43303	43383	43463	43543
CylCE-Item.11	42825	42905	42985	43065	43145	43225	43305	43385	43465	43545
CylCE-Item.12	42827	42907	42987	43067	43147	43227	43307	43387	43467	43547
CylCE-Item.13	42829	42909	42989	43069	43149	43229	43309	43389	43469	43549
CylCE-Item.14	42831	42911	42991	43071	43151	43231	43311	43391	43471	43551
CylCE-Item.15	42833	42913	42993	43073	43153	43233	43313	43393	43473	43553
CylCE-Item.16	42835	42915	42995	43075	43155	43235	43315	43395	43475	43555
CylCE-Item.17	42837	42917	42997	43077	43157	43237	43317	43397	43477	43557
CylCE-Item.18	42839	42919	42999	43079	43159	43239	43319	43399	43479	43559
CylCE-Item.19	42841	42921	43001	43081	43161	43241	43321	43401	43481	43561
CylCE-Item.20	42843	42923	43003	43083	43163	43243	43323	43403	43483	43563
CylCE-Item.21	42845	42925	43005	43085	43165	43245	43325	43405	43485	43565
CylCE-Item.22	42847	42927	43007	43087	43167	43247	43327	43407	43487	43567
CylCE-Item.23	42849	42929	43009	43089	43169	43249	43329	43409	43489	43569
CylCE-Item.24	42851	42931	43011	43091	43171	43251	43331	43411	43491	43571
CylCE-Item.25	42853	42933	43013	43093	43173	43253	43333	43413	43493	43573
CylCE-Item.26	42855	42935	43015	43095	43175	43255	43335	43415	43495	43575
CylCE-Item.27	42857	42937	43017	43097	43177	43257	43337	43417	43497	43577
CylCE-Item.28	42859	42939	43019	43099	43179	43259	43339	43419	43499	43579
CylCE-Item.29	42861	42941	43021	43101	43181	43261	43341	43421	43501	43581
CylCE-Item.33	42869	42949	43029	43109	43189	43269	43349	43429	43509	43589
CylCE-Item.38	42879	42959	43039	43119	43199	43279	43359	43439	43519	43599

Item	Item 1: Suction Pressure into cylinder (psig)	Item 21: Cylinder Friction (fraction)
	Item 2: Discharge Pressure out of cylinder (psig)	Item 22: Cylinder Slippage (fraction)
	Item 3: Suction temperature of gas into cylinder (°F)	Item 23: Deactivation Pressure source used (0=Suction, 1=Discharge)
	Item 4: Estimated discharge temperature of cylinder (°F)	Item 24: Cylinder MAWP (or max allowed pressure set in eRCM model) (psiG)
	Item 5: Z-Suction Compressibility Factor	Item 25: Suction Valves being Used in Active Compression Mode
	Item 6: Z-Discharge Compressibility Factor	Item 26: Discharge Valves being Used in Active Compression Mode
	Item 7: Suction Volumetric Efficiency (%)	Item 27: Suction Valves being Used in Deactivated End Mode
	Item 8: Discharge Volumetric Efficiency (%)	Item 28: Discharge Valves being Used in Deactivated End Mode
	Item 9: Fixed clearance (%) of cylinder end	Item 29: Throw Number on which this cylinder is located.
	Item 10: Effective clearance (%) of cylinder end	*Item 30: (reserved)*
	Item 11: Isentropic Efficiency (%) per end	*Item 31: (reserved)*
	Item 12: Adiabatic horsepower (BHP) used to compress gas per end	*Item 32: (reserved)*
	Item 13: Valve loss (BHP) used to move gas through valves	Item 33: Maximum allowed Discharge Temperature for this cylinder (°F)
	Item 14: Parasitic loss (BHP) used when end is deactivated	*Item 34: (reserved)*
	Item 15: Total load (BHP) used per end	*Item 35: (reserved)*
	Item 16: Flow (MMscfd) per end	*Item 36: (reserved)*
	Item 17: Which Stage of compression this cylinder serves	*Item 37: (reserved)*
	Item 18: Bore Diameter (in)	Item 38: Length of the Stroke for the VVCP on this cylinder end. (in)
	Item 19: Rod Diameter (in)	*Item 39: (reserved)*
	Item 20: End Active (1=Active, 0=Deactivated)	*Item 40: (reserved)*

RANGES:

ITEM	ADDRESS	Item Description
Range-01	43605	01. Suction Pressure (psiG) Min
Range-02	43607	02. Suction Pressure (psiG) Max
Range-03	43609	03. Discharge Pressure (psiG) Min
Range-04	43611	04. Discharge Pressure (psiG) Max
Range-05	43613	05. Speed (RPM) Min
Range-06	43615	06. Speed (RPM) Max
Range-07	43617	07. Torque (%) Min
Range-08	43619	08. Torque (%) Max
Range-09	43621	09. Ambient Temperature (°F) Min
Range-10	43623	10. Ambient Temperature (°F) Max
Range-11	43625	11. Stage 1 Suction (°F) Min
Range-12	43627	12. Stage 1 Suction (°F) Max
Range-13	43629	13. Stage 2 Suction (°F) Min
Range-14	43631	14. Stage 2 Suction (°F) Max
Range-15	43633	15. Stage 3 Suction (°F) Min
Range-16	43635	16. Stage 3 Suction (°F) Max
Range-17	43637	17. Stage 4 Suction (°F) Min
Range-18	43639	18. Stage 4 Suction (°F) Max
Range-19	43641	19. Stage 5 Suction (°F) Min
Range-20	43643	20. Stage 5 Suction (°F) Max
Range-21	43645	21. Stage 6 Suction (°F) Min
Range-22	43647	22. Stage 6 Suction (°F) Max

eRCM Express™

Sample Pseudo

Start Up Code

This is just a section of pseudo code for understanding the concept and the order. Actual code, syntax, optimization, calls, etc. are handled by the PLC programmers.

```
// ========================================
// Modbus Block Section References
// Used by PLC routines interacting with eRCM Express
// ========================================
eRCM_CommonWritesStart    = 40001
eRCM_CommonWritesLen      = 10
eRCM_SetViewerFileStart   = 40101
eRCM_SetViewerFileLen     = 1
eRCM_ForceCalcsStart      = 40273
eRCM_ForceCalcsLen        = 1
eRCM_CheckSafeStartUp     = 40107
eRCM_CheckSafeStartUpLen  = 1
eRCM_LStoSetforSU         = 40329
eRCM_LStoSetforSULen      = 1

eRCM_IsKernelBusyStart    = 40275
eRCM_IsKernelBusyLen      = 1
eRCM_CommonReadsStart     = 40277
eRCM_CommonReadsLen       = 13
eRCM_CommonFixedDataStart = 40325
eRCM_CommonFixedDataLen   = 16

eRCM_ErrorArrayStart      = 40445
eRCM_LoadArrayStart       = 40645
eRCM_FlowArrayStart       = 40845
// Make the ArrayLen equal to the max number of Load Steps from all model files!
eRCM_ArrayLen             = 30

eRCM_StageInfoStart       = 41045
eRCM_StageInfoPerStageLen = 30
eRCM_ThrowInfoStart       = 41405
eRCM_ThrowInfoPerThrowLen = 30
eRCM_HECylInfoStart       = 42005
eRCM_HECylInfoPerHECylLen = 40
eRCM_CECylInfoStart       = 42805
eRCM_CECylInfoPerCECylLen = 40
eRCM_RangeInfoStart       = 43605
eRCM_RangeInfoLen         = 22

eRCMExpressCount as Integer
// ========================================
```

```
// ========================================
// Compressor is warmed up, and we are ready to bring compressor online.
// First, load in the correct eRCM Viewer model, and then verify it.
// ========================================

  // Load in the correct file
  Modbus.NumberOfDataValues = eRCM_SetViewerFileLen
  Modbus.Address = eRCM_SetViewerFileStart
  Modbus.Data(1) = 2     // Load in the "2Two-stg Injection.rvf" file
  Modbus.Write()
  Pause 500 ms

  // Verify that this file is correct. If should be a 2-stage unit with 6 throws,
  // 6 cylinders, and 23 load steps.
  Modbus.NumberOfDataValues = eRCM_CommonFixedDataLen
  Modbus.Address = eRCM_CommonFixedDataStart
  Modbus.Read()
  // All must be true, else wrong file!
  // NumStgs=2 AND NumCyls=6 AND NumThrows=6 AND NumLSs=23
  IF Modbus.Data(11)=2 AND Modbus.Data(9)=6 AND _
     Modbus.Data(12)=6 AND Modbus.Data(10)=23 THEN
     MESSAGE "Correct eRCM Viewer model loaded."
  ELSE
     ALARM "Wrong eRCM Viewer model in eRCM Express. Stop unit!"
     SHUTDOWN
     END
  END IF

  // Check to see if we can force unit to start in the most safe load step.
  // This is only practical if access to the unit's final discharge pressure
  // is known. Unit's "actual" discharge pressure is likely about the same as
  // suction pressure since we are in bypass mode.
  IF (Field Discharge Pressure is Known) THEN

    Modbus.NumberOfDataValues = eRCM_CommonWritesLen
    Modbus.Address = eRCM_CommonWritesStart
    Modbus.Data(1) = UnitABC.CurrentLoadStep
    Modbus.Data(2) = UnitABC.Stage1.Ps_PSIG
    Modbus.Data(3) = UnitABC.Station.Pd_PSIG      // This item is SPECIAL!
    Modbus.Data(4) = UnitABC.Driver.CurrentRPM
    Modbus.Data(5) = UnitABC.Stage1.Ts_F
    Modbus.Data(6) = UnitABC.Stage2.Ts_F
    Modbus.Data(7) = 0
    Modbus.Data(8) = 0
    Modbus.Data(9) = 0
    Modbus.Data(10) = 0
    Modbus.Write()

    Modbus.NumberOfDataValues = eRCM_CheckSafeStartUpLen
    Modbus.Address = eRCM_CheckSafeStartUp
    Modbus.Data(1) = 1    // The "1" tells eRCM Express to return Safe Start Up LS
    Modbus.Write()

    Modbus.NumberOfDataValues = eRCM_ForceCalcsLen
    Modbus.Address = eRCM_ForceCalcsStart
```

```
    Modbus.Data(1) = 1  // Force a calculation of the compressor model
    Modbus.Write()

    // Wait for eRCM Express to finish calculation (make a subroutine!)
    Modbus.NumberOfDataValues = eRCM_IsKernelBusyLen
    Modbus.Address = eRCM_IsKernelBusyStart
    eRCMExpressCount = 0
    DO
      Pause 20 ms
      Modbus.ReadData()       // Read data in the "IsKernelBusy" register.
      If Modbus.Data(1) = 0 Then Exit DO     // If 0, calculations now complete.
      eRCMExpressCount = eRCMExpressCount + 1
    LOOP UNTIL eRCMExpressCount > 10         // Prevent Infinite Loop
    IF eRCMExpressCount > 10 THEN
      MSG "CRITICAL ISSUE: eRCM Express Unit does not appear to be returning data."
      // NOTE: If gateway device used, you may need to wait longer for updates.
      EXIT
    END IF

    Modbus.NumberOfDataValues = eRCM_ LStoSetforSULen
    Modbus.Address = eRCM_ LStoSetforSU
    Modbus.ReadData()
    IF Modbus.Data(1) <> -1 THEN
      CurrentLoadStep = Modbus.Data(1)
    ELSE
      // No safe load step found! Not good.
      // Company needs to decide if unit should NOT be allowed to go ONLINE, or
      // if they want to force a default load step to use instead.
      CurrentLoadStep = -1
    ENDIF

  ELSE

    // If we do not have access to final discharge pressure, then it is not clear
    // which (if any) load step to implement to bring unit online safely. Thus,
    // based on OEM, Operators, Engineering, the load step to use during closing
    // of the Bypass Valve has been determined to be "???". Thus, implement this
    // step.
    CurrentLoadStep = 23    // For Two-stage injection, use last load step, LS#23.

  ENDIF

  IF CurrentLoadStep > 0 THEN
    IMPLEMENT_LoadStep // Call routine physically implement current load step
  ELSE
    MSG "CRITICAL ISSUE: No safe load steps found for Start Up. Shut Down!"
    EXIT
  END IF

// ========================================
```

```
// ========================================
// Compressor is now online – Bypass Fully Closed.
// ========================================

  // Now, pass data to eRCM, get results back and take actions accordingly

    // Pass the current operating data
    Modbus.NumberOfDataValues = eRCM_CommonWritesLen
    Modbus.Address = eRCM_CommonWritesStart
    Modbus.Data(1) = UnitABC.CurrentLoadStep
    Modbus.Data(2) = UnitABC.Stage1.Ps_PSIG
    Modbus.Data(3) = UnitABC.Stage2.Pd_PSIG
    Modbus.Data(4) = UnitABC.Driver.CurrentRPM
    Modbus.Data(5) = UnitABC.Stage1.Ts_F
    Modbus.Data(6) = UnitABC.Stage2.Ts_F
    Modbus.Data(7) = 0
    Modbus.Data(8) = 0
    Modbus.Data(9) = 0
    Modbus.Data(10) = 0
    Modbus.Write()

    Modbus.NumberOfDataValues = eRCM_ForceCalcsLen
    Modbus.Address = eRCM_ForceCalcsStart
    Modbus.Data(1) = 1  // Force a calculation of the compressor model
    Modbus.Write()

    // Wait for eRCM Express to finish calculation (make a subroutine!)
    Modbus.NumberOfDataValues = eRCM_IsKernelBusyLen
    Modbus.Address = eRCM_IsKernelBusyStart
    eRCMExpressCount = 0
    DO
      Pause 20 ms
      Modbus.ReadData()       // Read data in the "IsKernelBusy" register.
      If Modbus.Data(1) = 0 Then Exit DO     // If 0, calculations now complete.
      eRCMExpressCount = eRCMExpressCount + 1
    LOOP UNTIL eRCMExpressCount > 10         // Prevent Infinite Loop
    IF eRCMExpressCount > 10 THEN
      MSG "CRITICAL ISSUE: eRCM Express Unit does not appear to be returning data."
      // NOTE: If gateway device used, you may need to wait longer for updates.
      EXIT
    END IF

    // Get results back
    Modbus.NumberOfDataValues = eRCM_CommonReadsLen
    Modbus.Address = eRCM_CommonReadsStart
    Modbus.Read()
    UnitABC.NSU      = Modbus.ReadData(2)
    UnitABC.NSD      = Modbus.ReadData(3)
    UnitABC.NSU_Perc = Modbus.ReadData(4)
    UnitABC.NSD_Perc = Modbus.ReadData(5)
    UnitABC.MinSpeedCurrLS = Modbus.ReadData(6)
    UnitABC.MaxSpeedCurrLS = Modbus.ReadData(7)
    UnitABC.MinPsCurrLS    = Modbus.ReadData(8)
    UnitABC.MaxPsCurrLS    = Modbus.ReadData(9)
    UnitABC.OptimalLS     = Modbus.ReadData(10)
```

```
UnitABC.CurrTorq_Perc = Modbus.ReadData(11)
UnitABC.UnitEff_Perf  = Modbus.ReadData(12)
UnitABC.FuelRate      = Modbus.ReadData(13)

Modbus.NumberOfDataValues = eRCM_ArrayLen
Modbus.Address = eRCM_ErrorArrayStart
Modbus.Read()
FOR I = 1 TO UnitABC.NumLoadSteps
  UnitABC.ErrorArray(I) = Modbus.ReadData(I)
NEXT I
Modbus.Address = eRCM_LoadArrayStart
Modbus.Read()
FOR I = 1 TO UnitABC.NumLoadSteps
  UnitABC.LoadArray(I) = Modbus.ReadData(I)
NEXT I
Modbus.Address = eRCM_FlowArrayStart
Modbus.Read()
FOR I = 1 TO UnitABC.NumLoadSteps
  UnitABC.FlowArray(I) = Modbus.ReadData(I)
NEXT I

// This remaining data is useful for display, but does not normally need to be
// retrieved each cycle. Rather, only retrieve it when needed for display.
// ----------------------------------
Modbus.NumberOfDataValues = eRCM_StageInfoPerStageLen
Modbus.Address = eRCM_StageInfoStart
FOR I = 1 TO UnitABC.NumStages
  Modbus.Read()
  FOR N = 1 to eRCM_StageInfoPerStageLen
    UnitABC.StageArray(I, N) = Modbus.ReadData(I)
  NEXT N
  Modbus.Address = Modbus.Address + 2*eRCM_StageInfoPerStageLen
NEXT I

Modbus.NumberOfDataValues = eRCM_ThrowInfoPerThrowLen
Modbus.Address = eRCM_ThrowInfoStart
FOR I = 1 TO UnitABC.NumThrows
  Modbus.Read()
  FOR N = 1 to eRCM_ThrowInfoPerThrowLen
    UnitABC.ThrowArray(I, N) = Modbus.ReadData(I)
  NEXT N
  Modbus.Address = Modbus.Address + 2* eRCM_ThrowInfoPerThrowLen
NEXT I

Modbus.NumberOfDataValues = eRCM_HECylInfoPerHECylLen
Modbus.Address = eRCM_HECylInfoStart
FOR I = 1 TO UnitABC.NumCylinders
  Modbus.Read()
  FOR N = 1 to eRCM_HECylInfoPerHECylLen
    UnitABC.HECylArray(I, N) = Modbus.ReadData(I)
  NEXT N
  Modbus.Address = Modbus.Address + 2*eRCM_HECylInfoPerHECylLen
NEXT I

Modbus.NumberOfDataValues = eRCM_CECylInfoPerCECylLen
```

```
    Modbus.Address = eRCM_CECylInfoStart
    FOR I = 1 TO UnitABC.NumCylinders
      Modbus.Read()
      FOR N = 1 to eRCM_CECylInfoPerCECylLen
        UnitABC.CECylArray(I, N) = Modbus.ReadData(I)
      NEXT N
      Modbus.Address = Modbus.Address + 2*eRCM_CECylInfoPerCECylLen
    NEXT I
    // ----------------------------------


    // Act on those results
    … Expertise of the automation/control team …

    // Compressor Errors for Unit (Compressor and Driver) Errors
    // The ErrorArray only returns errors associated with the compressor
    //   being unsafe. Overloading and/or underloading a driver (engine or motor)
    //   can lead to issues. Thus, if you want to invalidate load steps based on
    //   driver issues, the PLC needs to do that.
    // Next Step Up, Next Step Down, and OptimalLS are based on compressor safety
    //   and on over/under loading of driver, and on making sure that load step
    //   changes are not so larger that the change in load can lead to the engine
    //   surging and/or shutting down.

    // IF need for more load and NSU<>-1 THEN Load up to NSU…
    // IF need for less load and NSD<>-1 THEN Load down to NSD…
    // IF NSU=-1 AND NSD=-1 AND OptimalLS=-1 THEN SHUT DOWN! No safe load steps!

    // Display desired items of interest on various screens…

// ========================================
```

eRCM Express™

Modbus Register

Changes when

Replacing Older Units

When replacing an older eRCM Express unit (one with an industrial PC as its platform) with an eRCM Express with an mCore SDR as its platform, some Modbus register numbers will need to be changed, and a few other changes in the PLC and/or gateway devices will need to be implemented.

- If a gateway device is used, then it needs to clear (reset back to 0) the following three registers in its memory after writing them to the eRCM Express unit:
  - **ForceCondMonitoringCalcs**,
  - **ForceLivePressures**, and
  - **ForceERCMExpressCalculations**.

- When a recalculation of compressor performance and safety is desired, then after sending the operating conditions, a value of one (1) needs to be set in the **ForceERCMExpressCalculations** register and sent to eRCM Express.

- Interpretation of the bits in the ErrorArray() is still the same. However, retrieving the data for that array is a bit different now:
  - Previous: The registers were retrieved as FLOATS, which had to be converted to INTEGERs within the PLC before inspecting the bits.
  - New: The registers for (only) this array must now be retrieved directly as INTEGER, and thus no conversion is required before inspecting the bits.

To help with the updating of Modbus registers, the following tables show the previous Modbus register used, and its new corresponding register value in the mCore SDR unit:

eRCM Express - PC Platform (Old)	
NAME	ADDRESS
CurrLS	40005
PsG	40009
PdG	40011
RPM	40013
Ts1F	40015
Ts2F	40017
Ts3F	40019
Ts4F	40021
Ts5F	40023
Ts6F	40025
Next Viewer File Request	42799
DriverMaxBHP	42801
LSSelectionOnFlow	42723
CheckSafeStartup	42725
TorqSP	40001
LSMode	40003
TambF	40007
MinLoadFlowChangeAllowed	42719
MaxLoadChangeAllowed	42721

eRCM Express - mCore Platform (New)		
NAME	ADDRESS	
CurrLS	40001	
PsG	40003	
PdG	40005	
CurrSpeed	40007	
Ts1F	40009	
Ts2F	40011	
Ts3F	40013	
Ts4F	40015	
Ts5F	40017	
Ts6F	40019	
SetViewerFile	40101	
SetDriverMaxHP	40103	
LSSOnFlow	40105	
CheckSafeStartUp	40107	
TorqSP	40109	
LSMode	40111	
TambF	40113	
SetMinPercChange	40117	
SetMaxPercChange	40119	
ForceERCMExpressCalculations	40273	Must be set to "1" to force recalculations.

KrnlBsy	40027	KrnlBsy	40275	
WDPulse	40075	WDPulse	40277	
NxtLSUP	40031	NxtLSUP	40279	
NxtLSDN	40033	NxtLSDN	40281	
NSU_Perc	40071	NSU_Perc	40283	
NSD_Perc	40073	NSD_Perc	40285	
MinRPM	40035	MinRPM	40287	
MaxRPM	40037	MaxRPM	40289	
MinPs1	40039	MinPs1	40291	
MaxPs1	40041	MaxPs1	40293	
OptmLS	40029	OptmLS	40295	
CurrTorq	40047	CurrTorq	40297	
IsenEff	40053	IsenEff	40299	
SafeLoadStepStartup	42727	LStoSetforSU	40329	
AuxLoad	40045	AuxLoad	40331	
BHPMax	40049	BHPMax	40333	
BHPMax at TorqSP	40055	BHPMax at TorqSP	40335	
Elevation	40051	Elevation	40337	
Patm	40043	AtmPress	40339	
NumCyls	40061	NumCyls	40341	
NumLSs	40063	NumLSs	40343	
NumStgs	40065	NumStgs	40345	
NumThrws	40067	NumThrws	40347	
OEM ID	40069	OEM ID	40349	
MechEff	40059	MechEff	40351	
MaxDischF	40057	MaxDischF	40353	
RelHumid	40077	RelHumid	40355	
ERROR ARRAY:		**ERROR ARRAY:**		New unit provides 100 Load steps
40101	to 40199	Err.LS.01	40445 to 40643	instead of only 50 for older units
LOAD ARRAY:		**LOAD ARRAY:**		New unit provides 100 Load steps
40201	to 40299	Load.LS.01	40645 to 40843	instead of only 50 for older units
FLOW ARRAY:		**FLOW ARRAY:**		New unit provides 100 Load steps
40301	to 40399	Flow.LS.01	40845 to 41043	instead of only 50 for older units
STAGE ARRAY:		**STAGE ARRAY:**		
40401	to 40651	Stage-Item.01	41045 to 41403	Sub Items use same indexes
THROW ARRAY:		**THROW ARRAY:**		
40653	to 41171	Throw-Item.01	41405 to 42003	Sub Items use same indexes
HE_CYL ARRAY:		**HE_CYL ARRAY:**		
41173	to 41791	CylHE-Item.01	42005 to 42803	Sub Items use same indexes
CE_CYL ARRAY:		**CE_CYL ARRAY:**		
41793	to 42411	CylCE-Item.01	42805 to 43603	Sub Items use same indexes
RANGES:		**RANGES:**		
PsMin	42413	Range-01	43605	
PsMax	42415	Range-02	43607	
PdMin	42417	Range-03	43609	
PdMax	42419	Range-04	43611	
RPMmin	42421	Range-05	43613	
RPMmax	42423	Range-06	43615	
TorqMin	42425	Range-07	43617	
TorqMax	42427	Range-08	43619	
AmbTempMin	42429	Range-09	43621	
AmbTempMax	42431	Range-10	43623	
TsStg1Min	42433	Range-11	43625	
TsStg1Max	42435	Range-12	43627	
TsStg2Min	42437	Range-13	43629	
TsStg2Max	42439	Range-14	43631	
TsStg3Min	42441	Range-15	43633	
TsStg3Max	42443	Range-16	43635	
TsStg4Min	42445	Range-17	43637	
TsStg4Max	42447	Range-18	43639	
TsStg5Min	42449	Range-19	43641	
TsStg5Max	42451	Range-20	43643	
TsStg6Min	42453	Range-21	43645	
TsStg6Max	42455	Range-22	43647	

ACI Services, Inc.
125 Steubenville Ave. • Cambridge, Ohio 43725
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Phone: (740) 435-0240 • **Fax**: (740) 435-0260

eRCM Express™

Changes to Manual

by Version

From Version 2018-Feb-16 to Version 2018-Mar-5:

- Update of general images, and rewording of some text. No technical information changed.

eRCM Express™

Contact and

Support

Please Contact:

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For issues, questions, concerns, etc. related to:

- Compressor Models
- eRCM Express Product Features
- Software Diagnostics
- Integration of product features into Control Logic

Monico Inc.

18530 Klein Church Road
Spring, Texas 77379

P: 281-350-8751, Option 1

Website: www.MonicoInc.com

For issues, questions, concerns, etc. related to:

- Hardware Configuration
- Hardware Installation
- Electrical, Wiring, and Cabling
- Grounding
- Certifications and Rating