

# RSLogix Micro Project Report



Processor Information

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Processor Type: Bul.1763      MicroLogix 1100 Series A

Processor Name: UNTITLED

Total Memory Used: 1108 Instruction Words Used - 96 Data Table Words Used

Total Memory Left: 5548 Instruction Words Left

Program Files: 10

Data Files: 15

Program ID: 2df2

I/O Configuration

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0	Bul.1763	MicroLogix 1100 Series A
1		
2		
3		
4		

## Channel Configuration

## CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex

CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Edit Resource/Owner Timeout: 60  
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Passthru Link ID: 1  
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Write Protected: No  
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Comms Servicing Selection: Yes  
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Message Servicing Selection: Yes  
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex 1st AWA Append Character: \d  
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex 2nd AWA Append Character: \a

Source ID: 1 (decimal)  
Baud: 19200  
Parity: NONE  
Control Line : No Handshaking  
Error Detection: CRC  
Embedded Responses: Auto Detect  
Duplicate Packet Detect: Yes  
ACK Timeout(x20 ms): 50  
NAK Retries: 3  
ENQ Retries: 3

## CHANNEL 1 (SYSTEM) - Driver: Ethernet

CHANNEL 1 (SYSTEM) - Driver: Ethernet Edit Resource/Owner Timeout: 60  
CHANNEL 1 (SYSTEM) - Driver: Ethernet Passthru Link ID: 1  
CHANNEL 1 (SYSTEM) - Driver: Ethernet Write Protected: No  
CHANNEL 1 (SYSTEM) - Driver: Ethernet Comms Servicing Selection: Yes  
CHANNEL 1 (SYSTEM) - Driver: Ethernet Message Servicing Selection: Yes

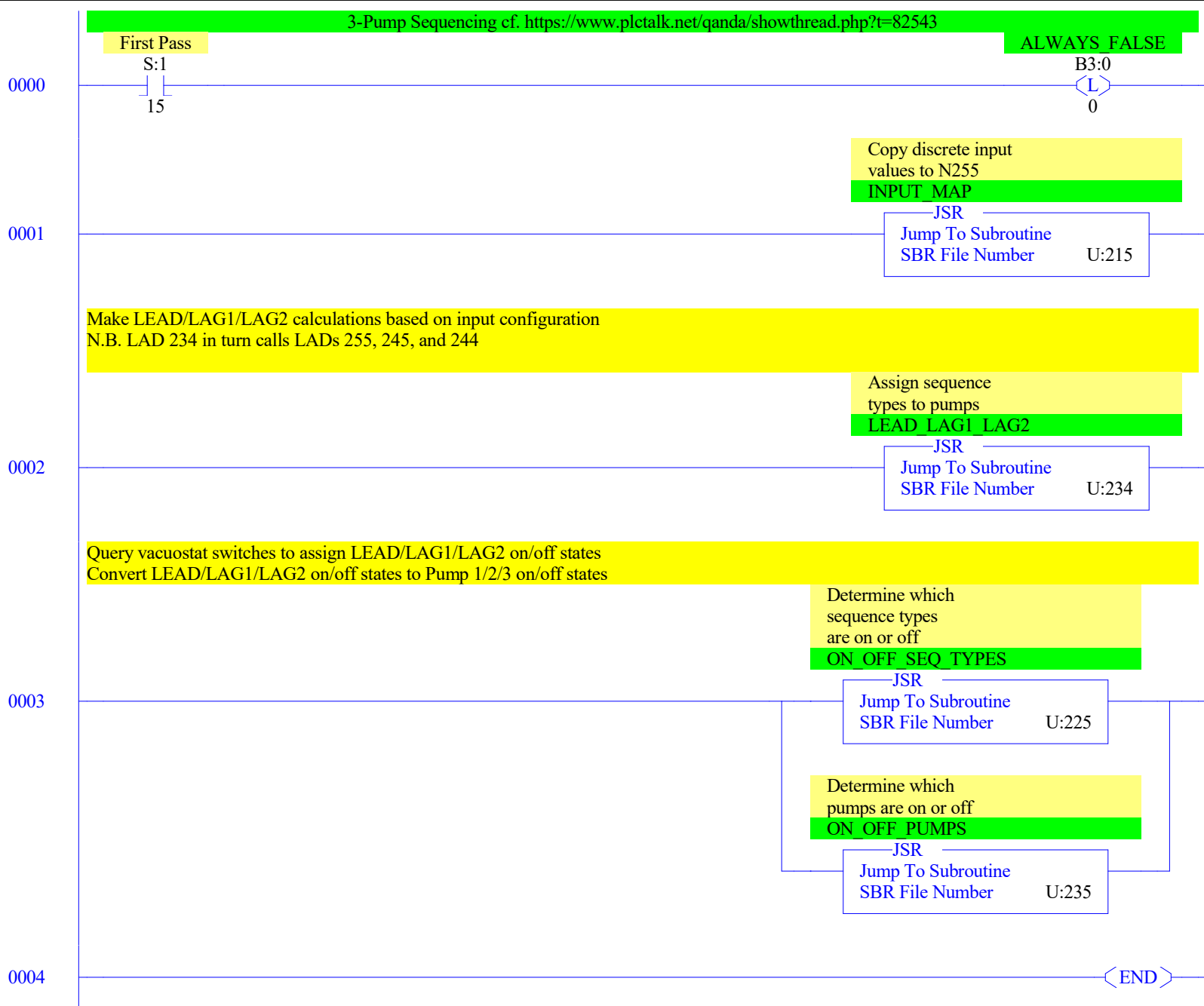
Hardware Address: 00:0F:73:01:72:04  
IP Address: 192.168.1.112  
Subnet Mask: 255.255.255.0  
Gateway Address: 192.168.1.1  
Msg Connection Timeout (x 1mS): 15000  
Msg Reply Timeout (x mS): 3000  
Inactivity Timeout (x Min): 30  
Bootp Enable: No  
Dhcp Enable No  
SNMP Enable: No  
HTTP Enable: Yes  
Auto Negotiate Enable: Yes  
Port Speed Enable: 10/100 Mbps Full Duplex/Half Duplex  
Contact:  
Location:

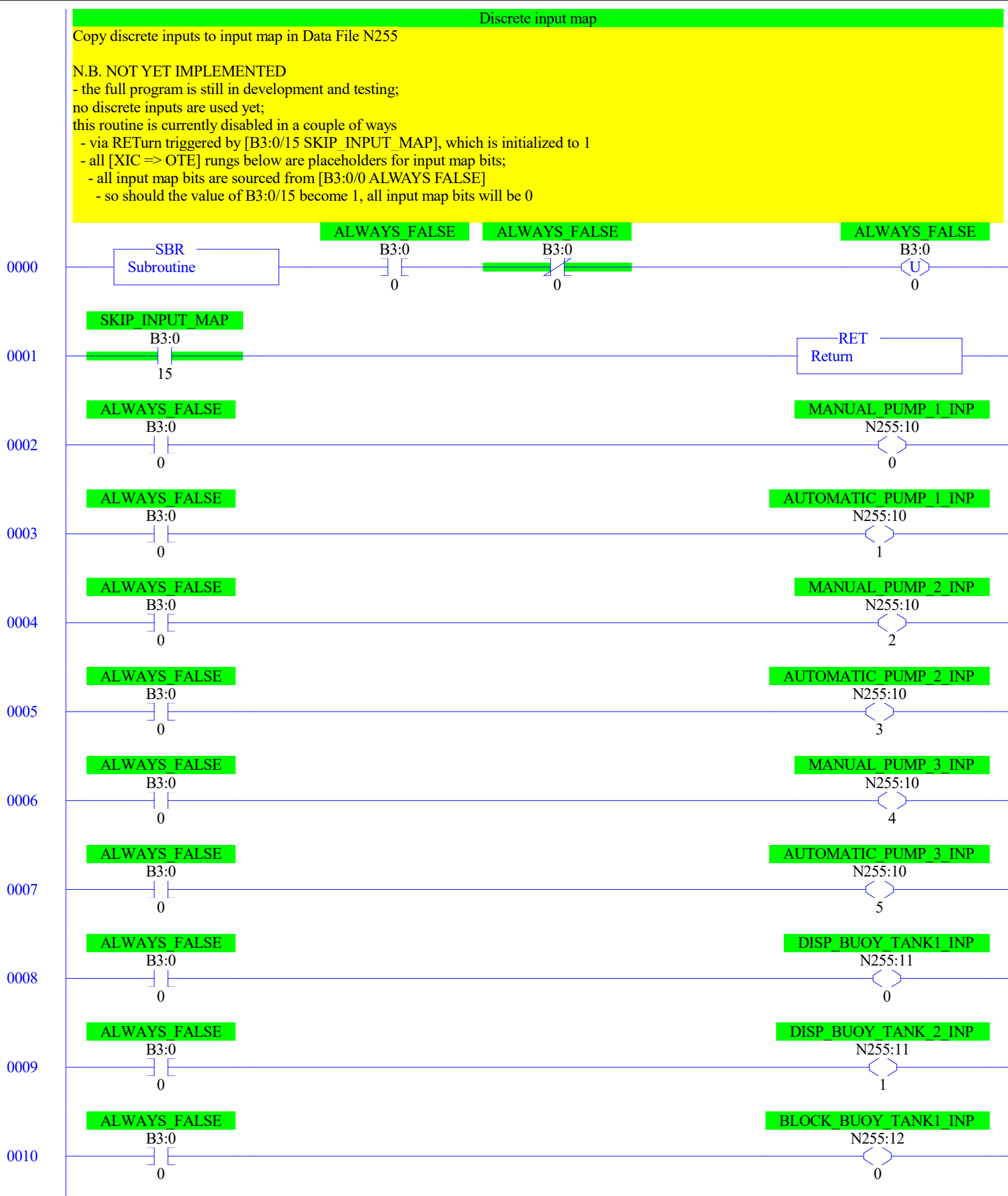
## Program File List

Name	Number	Type	Rungs	Debug	Bytes
[SYSTEM]	0	SYS	0	No	0
	1	SYS	0	No	0
MAIN	2	LADDER	5	No	59
INPUT_MAP	215	LADDER	15	No	229
ONOFFSQTYP	225	LADDER	5	No	150
LEADLAGLAG	234	LADDER	13	No	659
ONOFFPUMPS	235	LADDER	5	No	257
ONTMMINMAX	244	LADDER	6	No	319
ONTM_ACCUM	245	LADDER	5	No	239
MANAUTOMNT	255	LADDER	6	No	361

## Data File List

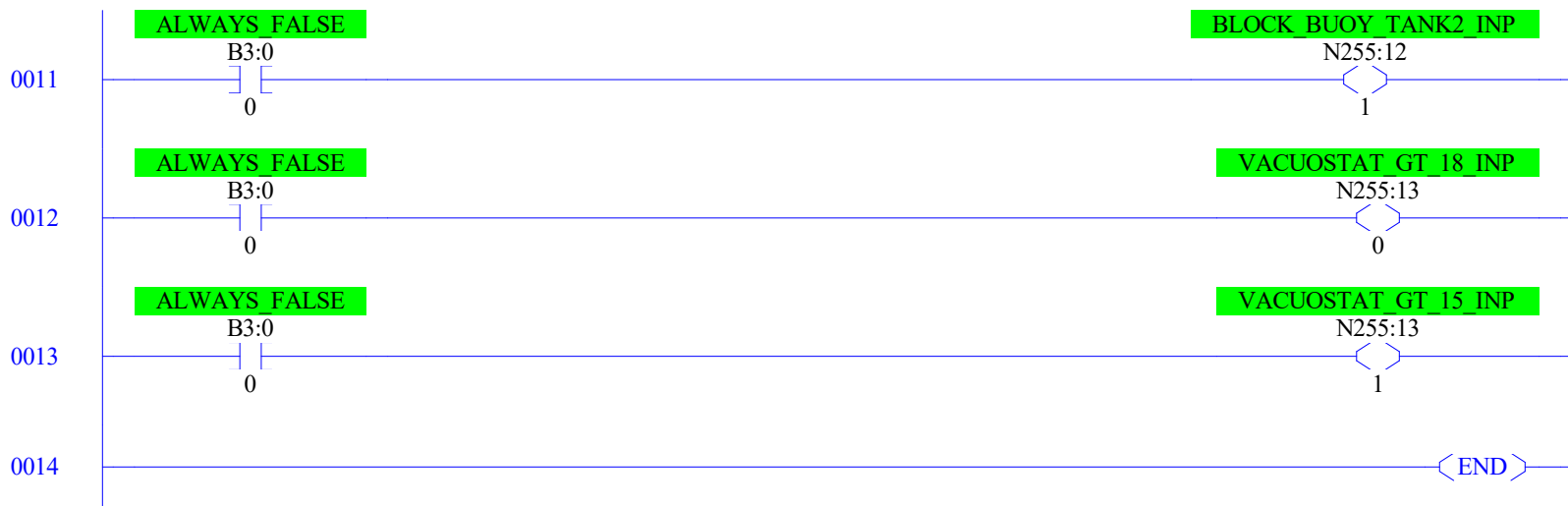
Name	Number	Type	Scope	Debug	Words	Elements	Last
OUTPUT	0	O	Global	No	12	4	O:3
INPUT	1	I	Global	No	18	6	I:5
STATUS	2	S	Global	No	0	66	S:65
BINARY	3	B	Global	No	1	1	B3:0
TIMER	4	T	Global	No	12	4	T4:3
COUNTER	5	C	Global	No	3	1	C5:0
CONTROL	6	R	Global	No	3	1	R6:0
INTEGER	7	N	Global	No	1	1	N7:0
FLOAT	8	F	Global	No	2	1	F8:0
MISC_INTS	200	N	Global	No	1	1	N200:0
ONOFFLOGIC	235	B	Global	No	1	1	B235:0
ONTMMINMAX	244	L	Global	No	8	4	L244:3
ONTM_LONGS	245	L	Global	No	12	6	L245:5
BIT_COUNTS	254	N	Global	No	8	8	N254:7
MANAUTOMNT	255	N	Global	No	14	14	N255:13







LAD 215 - INPUT\_MAP - Map data from discrete inputs to input map in N255 --- Total Rungs in File = 15



## Logic turning sequence pump types lead, lag1, lag2 on or off

Use the two vacuostat pressure switches to determine which sequence types, i.e. LEAD, LAG1, LAG2, of pump should be on or off

\*\*\*N.B. this Program File only controls whether LEAD, LAG1, and LAG2 pumps should be on;  
refer to Program File ONOFFPUMPS to translate those conditions to the physical pumps.

Above 18"Hg vacuum, all pumps should either be off or be turning off soon (see below)

For a decreasing vacuum (vacuostats change from 1 to 0):

- 1) When the vacuum drops below 18"Hg, turn on the LEAD pump
- 2) If the vacuum stays below 18"Hg continuously for 15s, turn on the LAG1 pump
- 3) If the vacuum drops below 15"Hg, turn on the LAG2 pump

For an increasing vacuum (vacuostats change from 0 to 1):

- 4) If vacuum stays above 15"Hg continuously for one minute, turn off the LAG2 pump,
- 5) If vacuum stays above 18"Hg continuously for fifteen seconds, turn off the LAG1 pump,
- 6) if vacuum stays above 18"Hg continuously for ten minutes, turn off the LEAD pump.

0000

ALWAYS FALSE

ALWAYS FALSE

ALWAYS FALSE

B3:0  
0B3:0  
0B3:0  
0

Logic for turning LEAD pump on or off

- 1) Turn on when vacuum drops below 18"Hg
- 2) Turn off when vacuum stays above 18"Hg continuously for 10 minutes

0001

VACUOSTAT GT 18 INP

DELAY LEAD OFF 10MIN

N255:13

0

TOF  
Timer Off Delay  
Timer  
Time Base  
Preset  
Accum

T4:0  
1.0  
600<  
0<

EN

DN

LEAD OFF DELAY DONE

T4:0

DN

LEAD ON

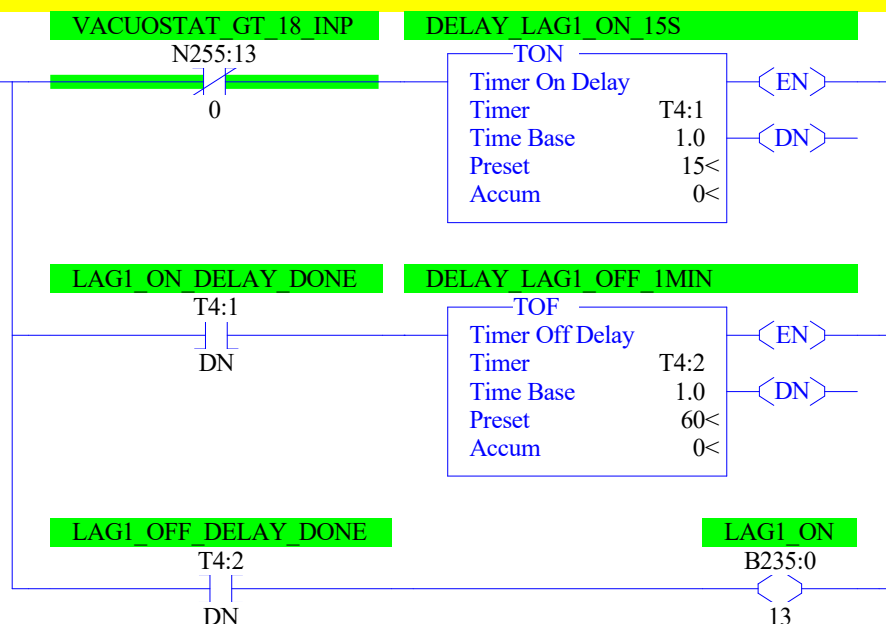
B235:0

12

0002

Logic for turning LAG1 pump on or off

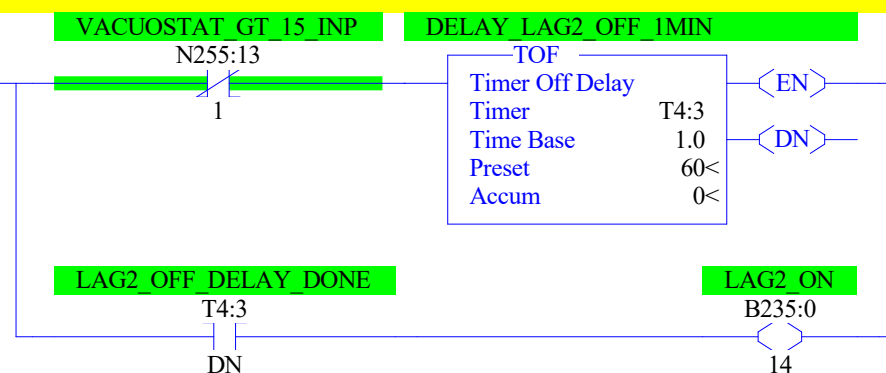
- 1) Turn on when vacuum stays below 18"Hg continuously for 15s
- 2) Turn off when vacuum stays above 18"Hg continuously for 1 minute



0003

Logic for turning LAG2 pump on or off

- 1) Turn on when vacuum is below 15"Hg
- 2) Turn off when vacuum stays above 15"Hg continuously for 1 minute



0004

END

### Logic to assign Lead-Lag1-Lag2 sequence types to physical pumps 1,2,3

This Program File will determine which of physical pumps 1, 2, and 3, are assigned as the sequence types lead (primary) pump, lag1 (secondary) pump, and lag2 (tertiary) pump

One pump must be assigned to each sequence type. In addition, each pump will be in one of three modes:

- 1) Manual, which means the pump will be turn on at all times.
- 2) Automatic, which means the pump will be turned on and off as needed to maintain system vacuum level
- 3) Maintenance, which means the pump will not be turned on at any time

The sequence types (i.e. lead, lag1, and lag2) determine the order in which pumps are turned on as the vacuum decreases. I.e. at first the lead pump will be turned on by itself, then lead+lag1 together, then lead+lag1+lag2 i.e. all together.

Merging this with the modes,

- a pump in Manual mode is akin to the lead end of the sequence type progression (earlier on; later off)
- a pump in Maintenance mode is akin to the lag2 end of the progression (later on; earlier off)
- Although a pump in Maintenance mode will never actually come on, it is still better to place it at the lag2 end so pumps in all other modes will be turned on before the vacuum drops to the point that the lag2 pump is called to be on

With that in mind, the algorithm in this Program File will take the following approach:

Update pump modes, ON times, and maximum and minimum values of ON times for pumps in Automatic mode

- if the lead/lag1/lag2 assignments are not to be changed on this scan (bit [RESEQUENCE] value is 0) , then keep all current assignments

If bit [RESEQUENCE] is 1, then fill in the following matrix with three 1s and six 0s:

	Pumps		
	1	2	3
LEAD	A	B	c
LAG1	g	h	i
LAG2	f	E	D

where

- Each row will be assigned one 1 and two 0s, indicating one pump is assigned to that rows sequence type
- Each column will be assigned one 1 and two 0s, indicating one sequence type is assigned to that column's pump
- LEAD elements A and B are filled in first, favoring
  - first the lowest-numbered pump in Manual mode if any exist,
  - then the lowest-numbered pump in Automatic mode with the least ON time if any exist,
  - finally pump 1 if all three pumps are in Maintenance mode
- LAG2 elements D and E are filled in next, favoring
  - first the highest-numbered pump in Maintenance mode if any exist,
  - then the highest-numbered pump in Automatic mode with the most ON time if any exist
  - finally pump3 if all three pumps are in Manual mode
- All other elements c, f, g, h, i, will be filled in by difference, ensuring there is one 1-bit in each row and in each column



0001

Update configuration and status: modes; cumulative per-pump ON times; maximum and minimum ON times of pumps in Automatic mode

Assign which pumps  
are in Manual mode  
or Automatic mode or  
Maintenance mode

MAN\_AUTO\_MAINT

JSR

Jump To Subroutine  
SBR File Number

U:255

Accumulate ON times,  
i.e. runtimes,  
for all pumps

ACCUMULATE\_ON\_TIMES

JSR

Jump To Subroutine  
SBR File Number

U:245

Calculate minimum  
and maximum ON times  
for pumps in  
Automatic mode

MIN\_MAX\_ON\_TIMES\_AUT

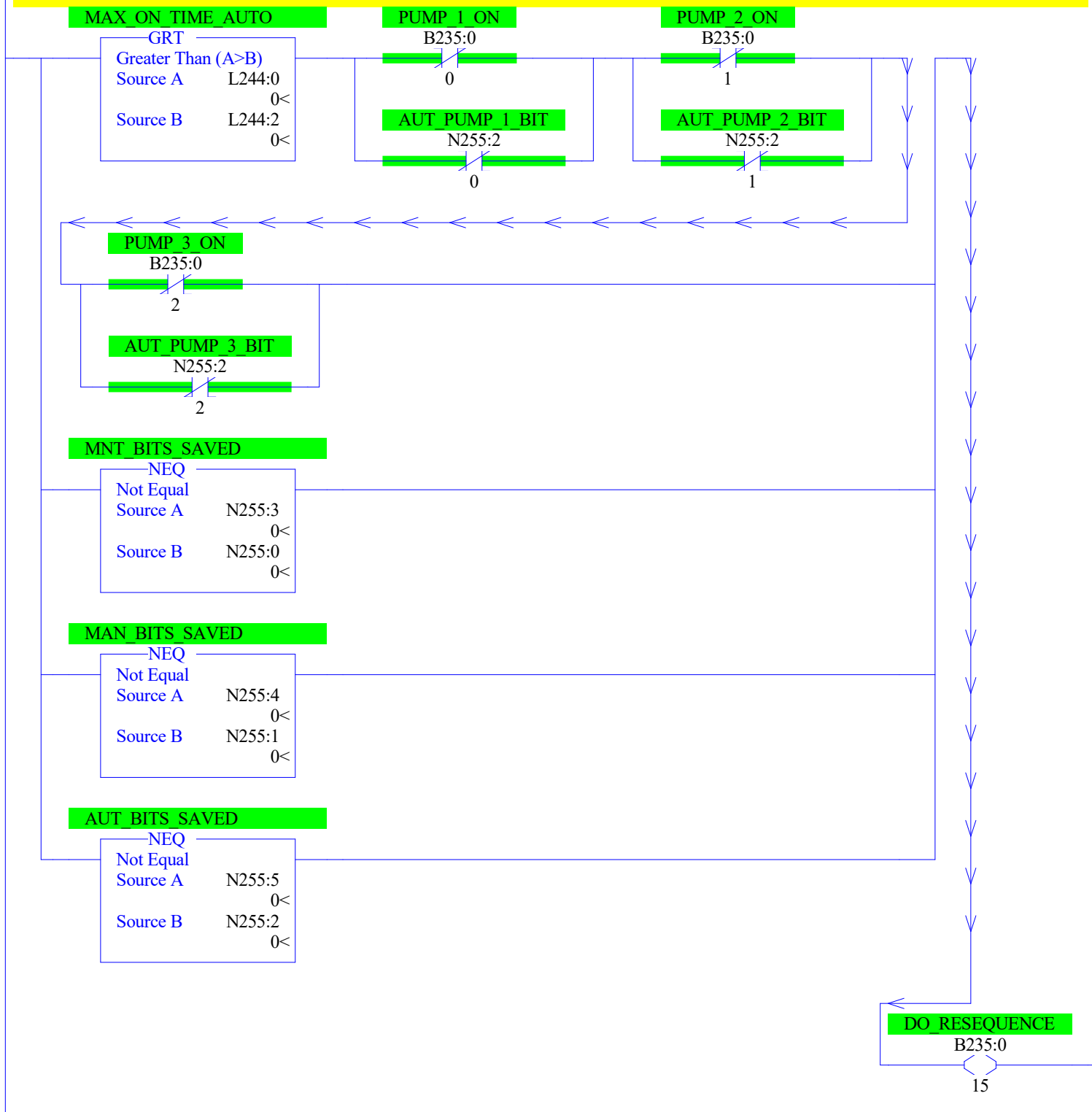
JSR

Jump To Subroutine  
SBR File Number

U:244

Assign value of 1 to bit DO\_RESEQUENCE if  
 - any pump's ON time exceeds any other pump's by too much AND no pumps are ON in Automatic mode  
 OR  
 - any modes changed on this scan

0002



A) Assign Pump 1 as LEAD IF:

- no re-sequence and Pump 1 was LEAD on previous scan

OR

- re-sequence AND one of the following is true

- Pump 1 is in Manual mode

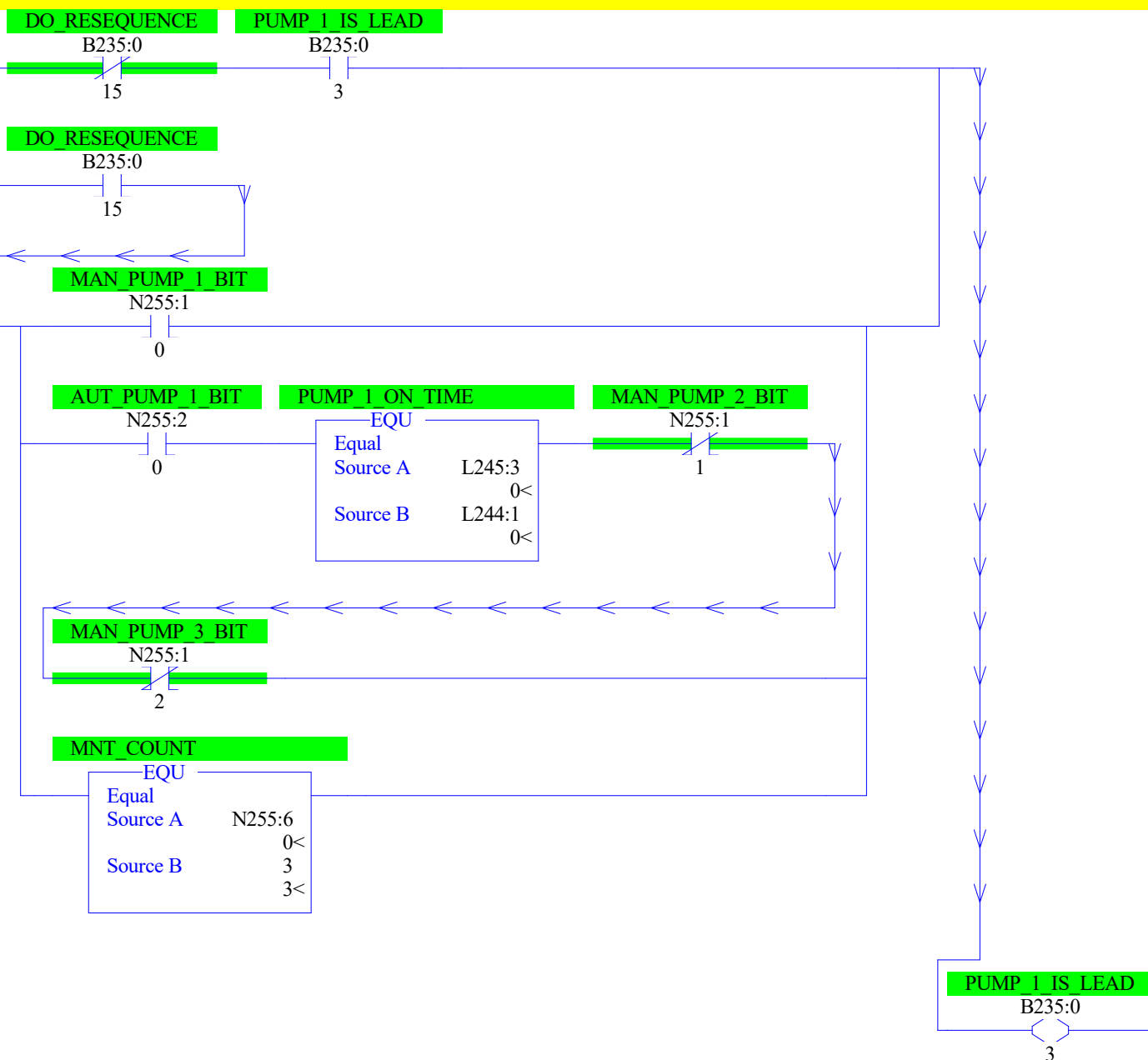
OR

- Pump 1 is in Automatic mode AND Pump 1 ON time equals minimum ON time of any pump in Automatic mode AND no other pump is in Manual mode

OR

- All 3 pumps are in maintenance mode

0003



## B) Assign Pump 2 as LEAD IF:

- no re-sequence and Pump 2 was LEAD on previous scan

OR

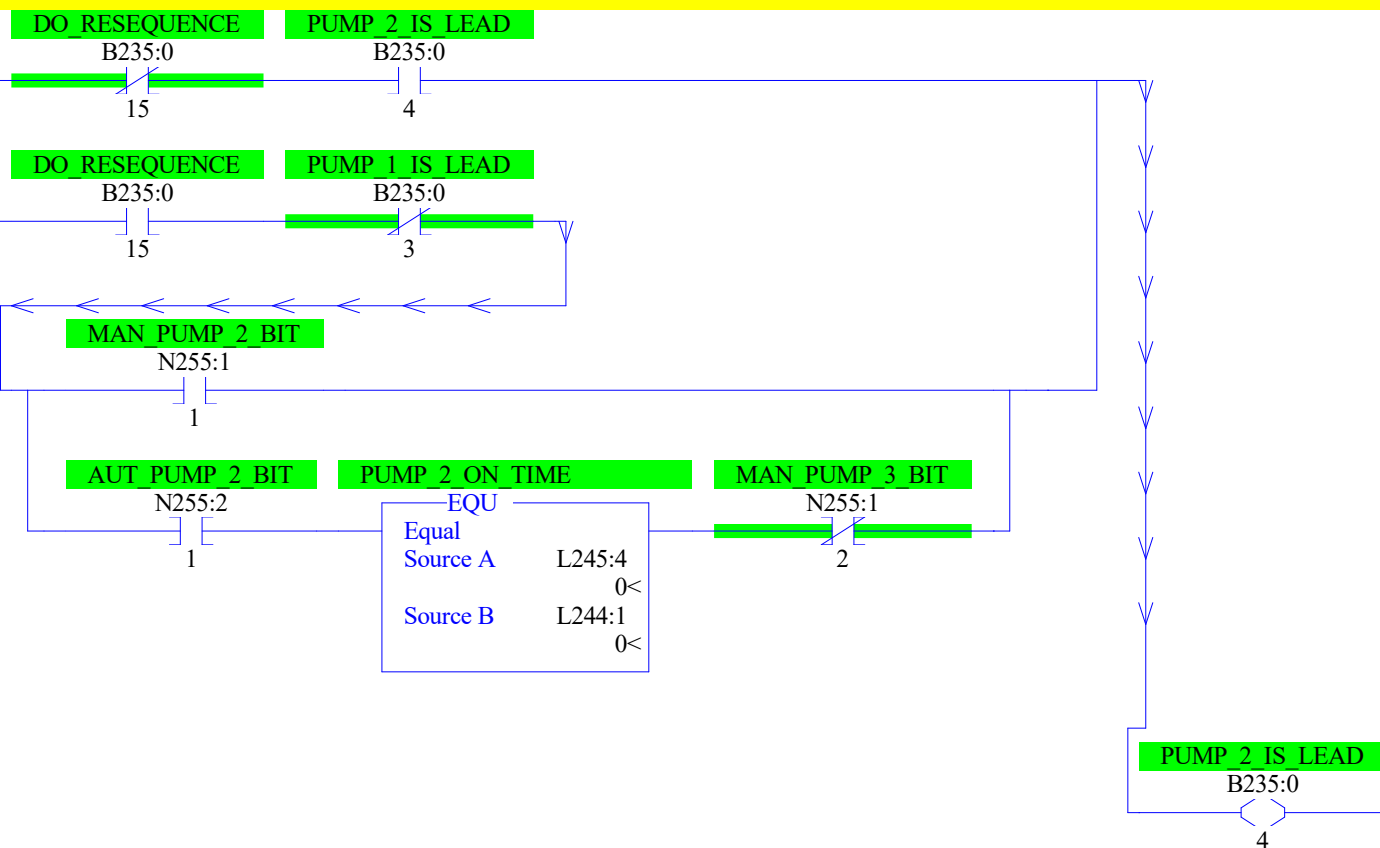
- re-sequence AND pump 1 is not already LEAD (see previous rung) and either

- Pump 2 is in Manual mode

OR

- Pump 2 is in Automatic mode AND Pump 2 ON time equals minimum ON time of any pump in Automatic mode AND Pump 3 is not in Manual mode

0004



## c) Assign Pump 3 as LEAD IF:

- Pumps 1 and 2 are not LEAD

0005





## D) Assign Pump 3 as LAG2 IF:

- no re-sequence and Pump 3 was LAG2 on previous scan

OR

- resequence AND either

- Pump 3 is in Maintenance mode

OR

- Pump 3 is in Automatic mode and Pump 3 ON time is equal to maximum ON time of any pump in Automatic mode AND no other pump is in Maintenance mode

OR

- all pumps are in Manual mode

0006

DO RESEQUENCE

B235:0

15

PUMP 3 IS LAG2

B235:0

11

DO RESEQUENCE

B235:0

15

MNT PUMP 3 BIT

N255:0

2

AUT PUMP 3 BIT

N255:2

2

PUMP 3 ON TIME

EQU

Equal  
Source A

L245:5

0&lt;

Source B

L244:0

0&lt;

MNT PUMP 2 BIT

N255:0

1

MNT PUMP 1 BIT

N255:0

0

MAN COUNT

EQU

Equal  
Source A

N255:7

0&lt;

Source B

3

3&lt;

PUMP 3 IS LAG2

B235:0

11

E) Assign Pump 2 as LAG2 IF:

- no resequence and Pump 2 was LAG2 on previous scan

OR

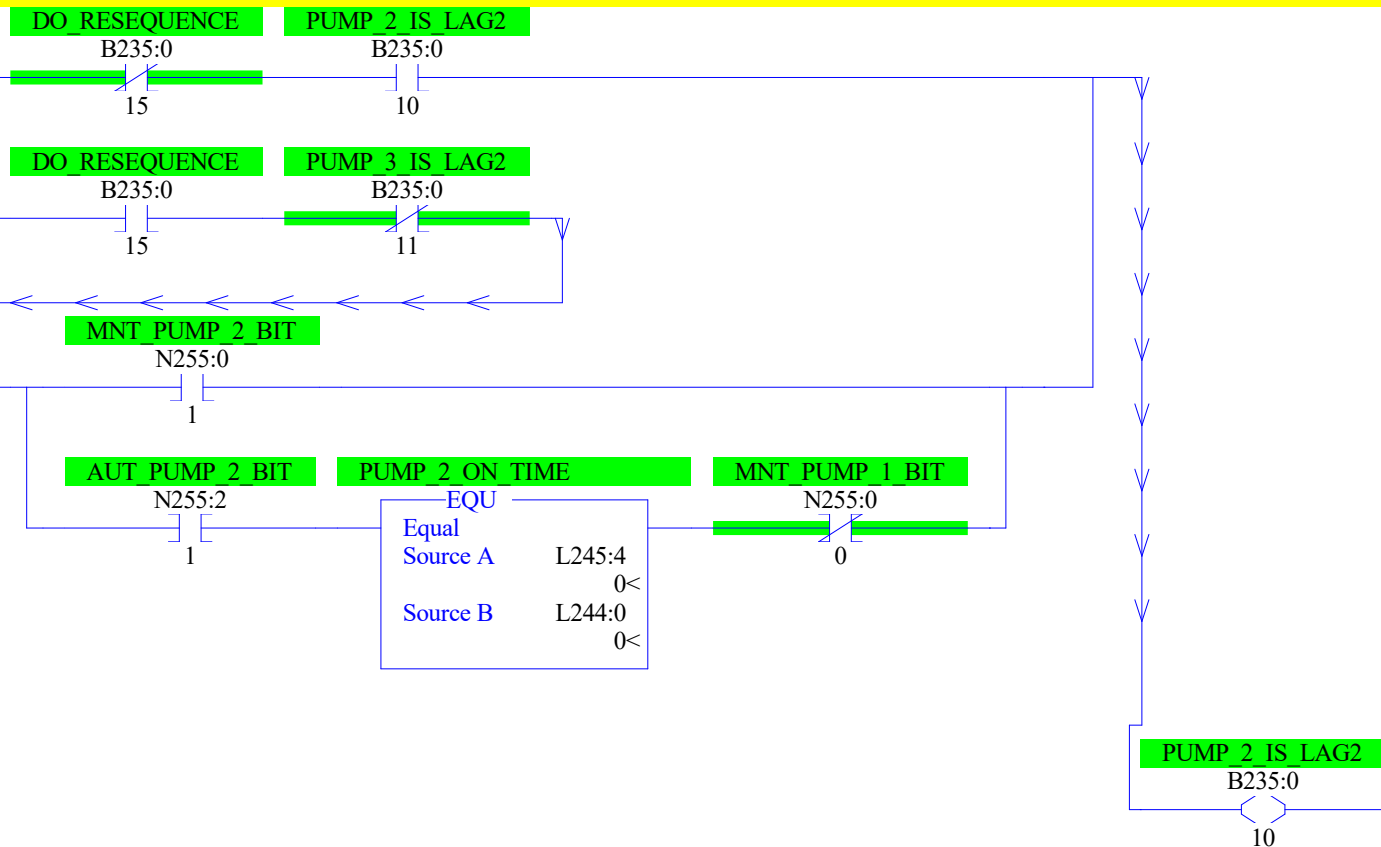
- re-sequence AND Pump 3 is not LAG already (see previous rung) AND either

- Pump 2 is in Maintenance mode

OR

- Pump 2 is in Automatic mode AND Pump 2 ON time equals maximum ON time of any pump in Automatic mode AND Pump 1 is not in Maintenance mode

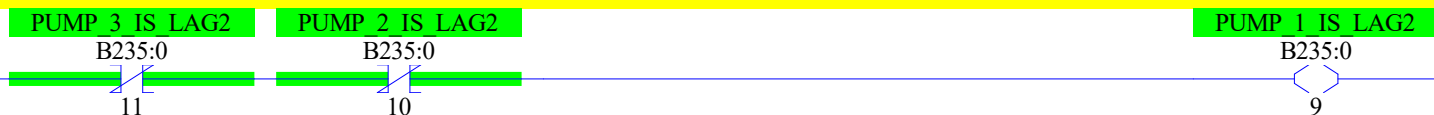
0007



f) Assign Pump 1as LAG2 IF:

- Pumps 2 and 3 are not LAG2

0008



g) Assign Pump 1 as LAG1 IF:

- Pump 1 is neither LEAD nor LAG2

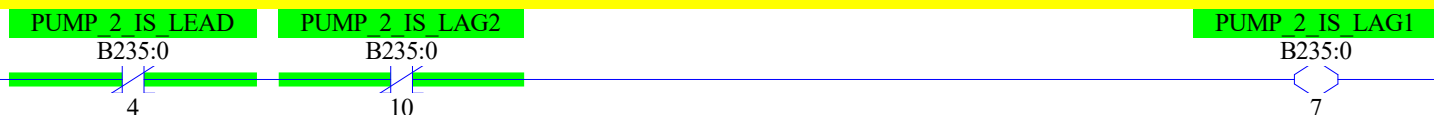
0009



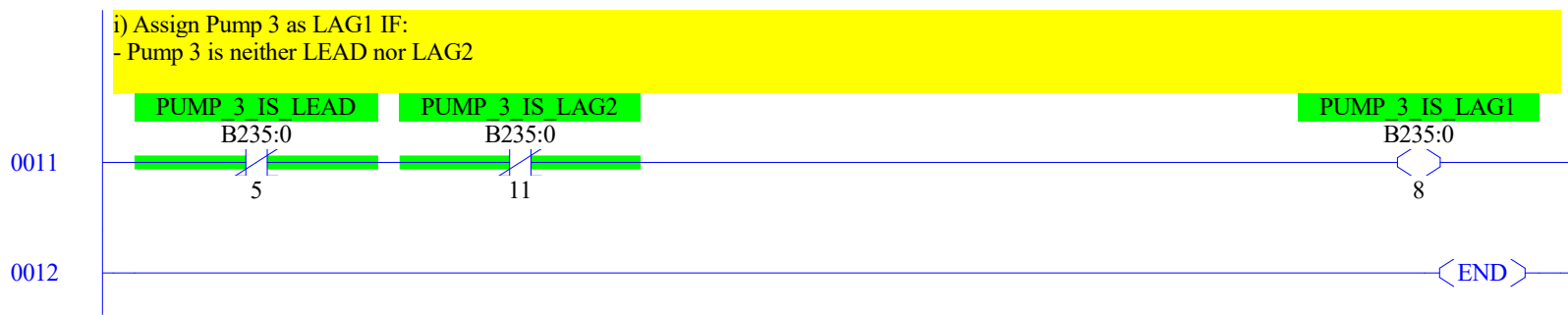
h) Assign Pump 2 as LAG1 IF:

- Pump 2 is neither LEAD nor LAG2

0010



LAD 234 - LEADLAGLAG - Logic to assign sequence types to physical pumps --- Total Rungs in File = 13



## Logic for turning pumps 1, 2, and 3, on or off

Other Program Files have determined whether each of the LEAD, LAG1, and LAG2 pumps are on or off,  
as well as whether each pump is in Manual, Automatic, or Maintenance moded  
This Program File combines those conditions into whether physical pumps 1, 2, or 3 should be on or off

0000

SBR  
Subroutine

ALWAYS FALSE

B3:0  
0

ALWAYS FALSE

B3:0  
0

Turn Pump 1 on IF either:

- Pump 1 is in Manual mode,
- OR
- Pump 1 is in Automatic mode, AND either
  - LEAD pump is on and Pump 1 is LEAD pump
  - OR
  - LAG1 pump is on and Pump 1 is LAG1 pump
  - OR
  - LAG2 pump is on and Pump 1 is LAG2 pump

0001

MAN\_PUMP\_1\_BIT

N255:1

0

AUT\_PUMP\_1\_BIT

N255:2

0

LEAD ON

B235:0

12

PUMP\_1\_IS\_LEAD

B235:0

3

LAG1 ON

B235:0

13

PUMP\_1\_IS\_LAG1

B235:0

6

LAG2 ON

B235:0

14

PUMP\_1\_IS\_LAG2

B235:0

9

PUMP\_1\_ON

B235:0

0

Do the same for Pump 2

0002

MAN\_PUMP\_2\_BIT

N255:1

1

AUT\_PUMP\_2\_BIT

N255:2

1

LEAD ON

B235:0

12

PUMP\_2\_IS\_LEAD

B235:0

4

LAG1 ON

B235:0

13

PUMP\_2\_IS\_LAG1

B235:0

7

LAG2 ON

B235:0

14

PUMP\_2\_IS\_LAG2

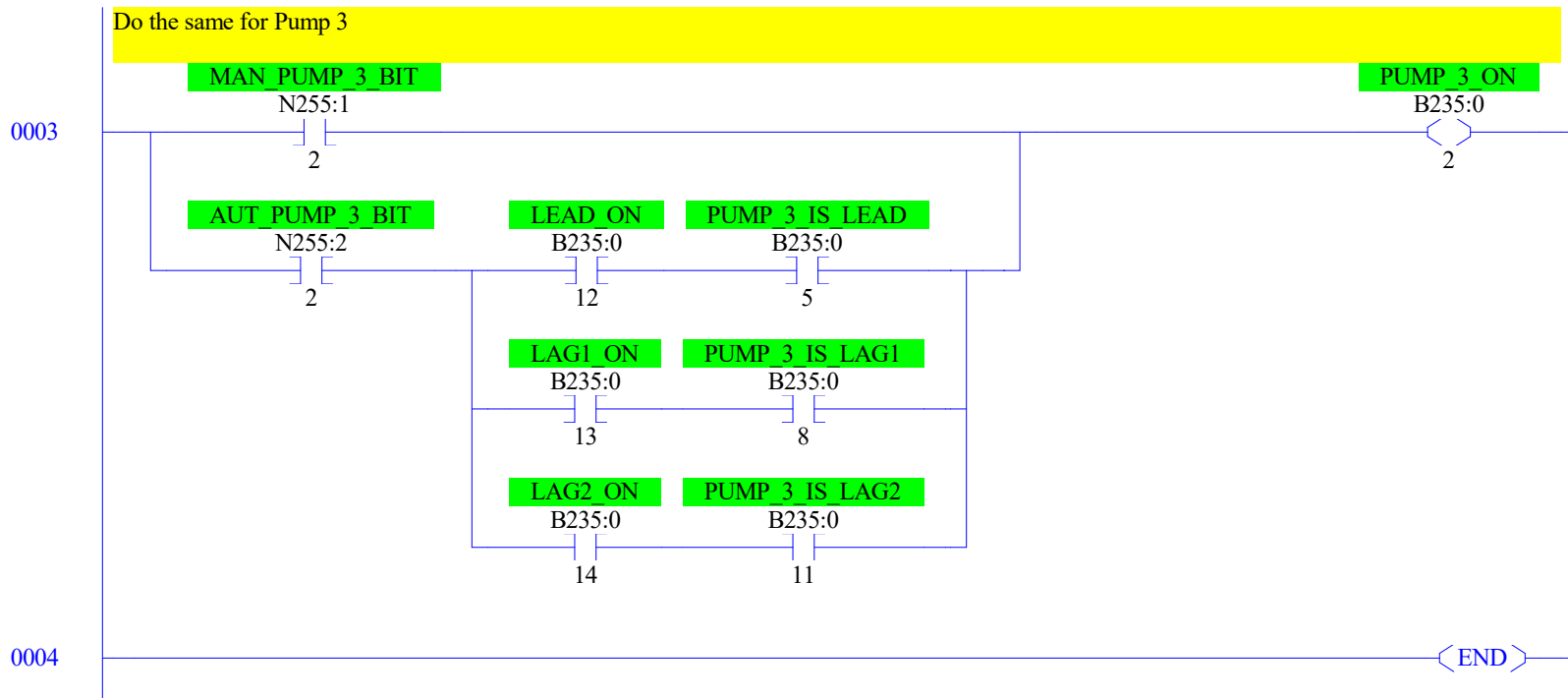
B235:0

10

PUMP\_2\_ON

B235:0

1



## Calculate max and min ON times for pumps in Auto mode

## Initialization

- 1) Assign 0 to maximum ON time value
- 2) Overwrite maximum ON time value using current ON time of any pump in Auto mode
- 2) Duplicate initialized maximum ON time value to minimum ON time value

## MAX ON TIME AUTO

CLR

Clear  
Dest L244:0  
0<

## AUT PUMP 1 BIT

N255:2

0

## MAX ON TIME AUTO

MOV

Move  
Source L245:3  
0<  
Dest L244:0  
0<

## AUT PUMP 2 BIT

N255:2

1

## MAX ON TIME AUTO

MOV

Move  
Source L245:4  
0<  
Dest L244:0  
0<

## AUT PUMP 3 BIT

N255:2

2

## MAX ON TIME AUTO

MOV

Move  
Source L245:5  
0<  
Dest L244:0  
0<

## MIN ON TIME AUTO

MOV

Move  
Source L244:0  
0<  
Dest L244:1  
0<

0000

0001

If Pump 1 is in Auto mode, then

- if pump 1 ON time value is greater than max ON time value, then copy Pump 1 ON time value to max ON time value
- if pump 1 ON time value is less than min ON time value, then copy Pump 1 ON time value to min ON time value

AUT\_PUMP\_1\_BIT

N255:2

0

PUMP\_1\_ON\_TIME

GRT  
Greater Than (A>B)

Source A L245:3  
0<

Source B L244:0  
0<

MAX\_ON\_TIME\_AUTO

MOV

Move  
Source L245:3  
0<

Dest L244:0  
0<

PUMP\_1\_ON\_TIME

LES  
Less Than (A<B)

Source A L245:3  
0<

Source B L244:1  
0<

MIN\_ON\_TIME\_AUTO

MOV

Move  
Source L245:3  
0<

Dest L244:1  
0<

0002

If Pump 2 is in Auto mode, then

- if pump 2 ON time value is greater than max ON time value, then copy Pump 2 ON time value to max ON time value
- if pump 2 ON time value is less than min ON time value, then copy Pump 2 ON time value to min ON time value

AUT\_PUMP\_2\_BIT

N255:2

1

PUMP\_2\_ON\_TIME

GRT  
Greater Than (A>B)

Source A L245:4  
0<

Source B L244:0  
0<

MAX\_ON\_TIME\_AUTO

MOV

Move  
Source L245:4  
0<

Dest L244:0  
0<

PUMP\_2\_ON\_TIME

LES  
Less Than (A<B)

Source A L245:4  
0<

Source B L244:1  
0<

MIN\_ON\_TIME\_AUTO

MOV

Move  
Source L245:4  
0<

Dest L244:1  
0<

0003

If Pump 2 is in Auto mode, then

- if pump 2 ON time value is greater than max ON time value, then copy Pump 2 ON time value to max ON time value
- if pump 2 ON time value is less than min ON time value, then copy Pump 2 ON time value to min ON time value

AUT\_PUMP\_3\_BIT

N255:2

2

PUMP\_3\_ON\_TIME

GRT  
Greater Than (A>B)

Source A L245:5  
0<

Source B L244:0  
0<

MAX\_ON\_TIME\_AUTO

MOV

Move  
Source L245:5  
0<

Dest L244:0  
0<

PUMP\_3\_ON\_TIME

LES  
Less Than (A<B)

Source A L245:5  
0<

Source B L244:1  
0<

MIN\_ON\_TIME\_AUTO

MOV

Move  
Source L245:5  
0<

Dest L244:1  
0<

Add offset to minimum ON time to get ON time which maximum ON time must exceed to trigger a re-sequencing of pumps

ONTIM TO RESEQUENCE

ADD

Add

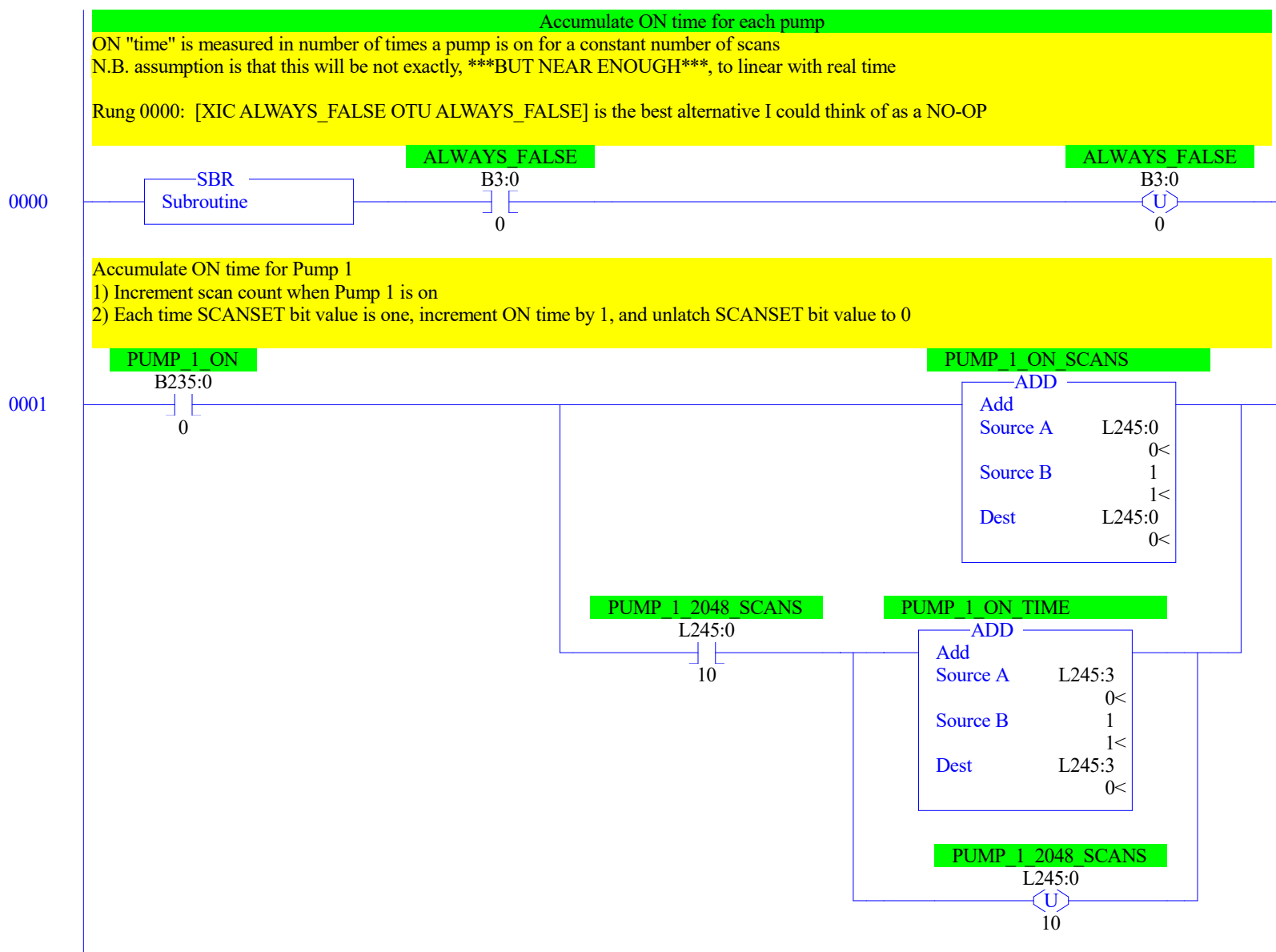
Source A L244:1  
0<

Source B L244:3  
300<

Dest L244:2  
0<

END





0002

Do the same for Pump 2

PUMP\_2\_ON

B235:0

1

PUMP\_2\_ON\_SCANS

ADD

Add	
Source A	L245:1
	0<
Source B	1
	1<
Dest	L245:1
	0<

PUMP\_2\_2048\_SCANS

L245:1

10

PUMP\_2\_ON\_TIME

ADD

Add	
Source A	L245:4
	0<
Source B	1
	1<
Dest	L245:4
	0<

PUMP\_2\_2048\_SCANS

L245:1

U
10

0003

Do the same for Pump 3

PUMP\_3\_ON

B235:0

2

PUMP\_3\_ON\_SCANS

ADD

Add	
Source A	L245:2
	0<
Source B	1
	1<
Dest	L245:2
	0<

PUMP\_3\_2048\_SCANS

L245:2

10

PUMP\_3\_ON\_TIME

ADD

Add	
Source A	L245:5
	0<
Source B	1
	1<
Dest	L245:5
	0<

PUMP\_3\_2048\_SCANS

L245:2

U
10

0004

END
-----

## Assign bits for which pumps are in Maintenance, Manual, or Auto mode

There are three pumps.

Depending on the MANUAL and AUTO discrete input bits for each pump, that pump is in exactly one of three operating modes: Maintenance; Manual; Auto.

- Maintenance: a pump is in Maintenance mode if (its MANUAL input is 0) AND (its AUTO input is 0)
- Manual: a pump is in Manual mode if its MANUAL input bit is 1; it does not matter what its AUTO input is
- Auto: a pump is in Auto mode if it is neither in Maintenance mode nor in Manual mode; this is the same as if (its MANUAL input is 0) AND (its AUTO input is 1)

## Initialization

- 1) COPY previous scans three sets of modes to saved modes
- 2) Clear what will become the current scan's three sets of modes

## #MNT\_BITS\_SAVED

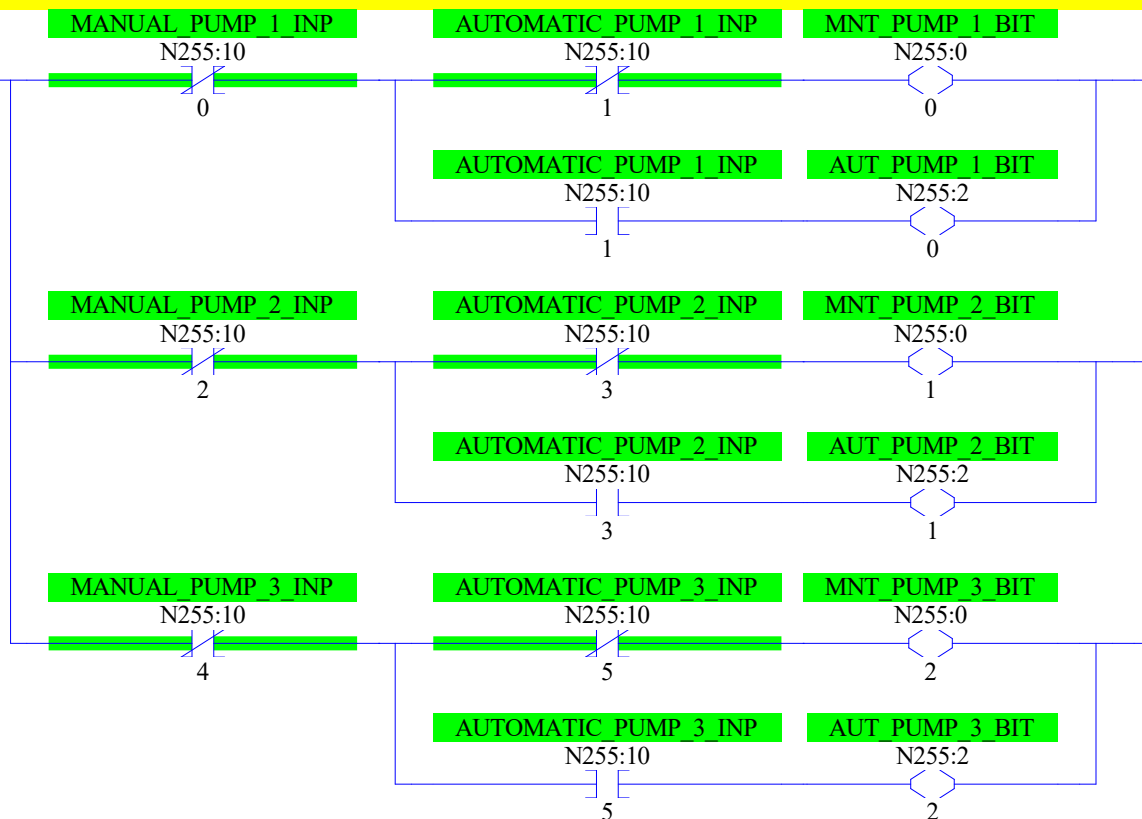
COP  
Copy File  
Source #N255:0  
Dest #N255:3  
Length 3

## #MNT\_PUMP\_BITS

FLL  
Fill File  
Source 0  
Dest #N255:0  
Length 3

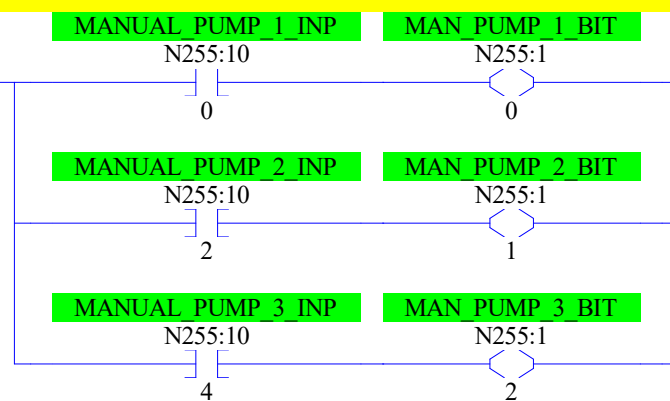
A pump that (its Manual input value as 0) AND (its Automatic input value as 0) is in Maintenance mode

A pump that (its Manual input value as 0) AND (its Automatic input value as 1) is in Auto mode



0002

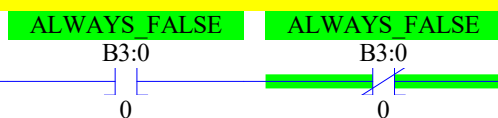
A pump that has (its Manual input value as 1) is in Manual mode



0003

A pump that is neither in Maintenance mode nor in Manual mode is in Auto mode

- Currently disabled, as this logic is handled above in rung 0001 sub-branches like this: [XIC AUTOMATIC\_PUMP\_n\_INP OTE AUT\_PUMP\_3\_BIT]



AUT\_PUMP BITS

OR

Bitwise Inclusive OR

Source A N255:0  
0000h<Source B N255:1  
0000h<Dest N255:2  
0000h<

AUT\_PUMP BITS

XOR

Bitwise Exclusive OR

Source A N255:2  
0000h<Source B 7  
7<Dest N255:2  
0000h<

Get count of 1-bits of each type: Maintenance; Manual; Automatic. \*\*\*N.B. Automatic count is not used anywhere else

**MNT\_COUNT**

MOV

Move  
Source N254:[N255:0]  
0<  
Dest N255:6  
0<

**MAN\_COUNT**

MOV

Move  
Source N254:[N255:1]  
0<  
Dest N255:7  
0<

**AUT\_COUNT**

MOV

Move  
Source N254:[N255:2]  
0<  
Dest N255:8  
0<

END

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0				
O:0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix	1100	Series A
O:0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix	1100	Series A
O:0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix	1100	Series A
O:0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix	1100	Series A

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0				
I:0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix	1100	Series A
I:0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix	1100	Series A
I:0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix	1100	Series A
I:0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix	1100	Series A
I:0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	Bul.1763	MicroLogix	1100	Series A-Analog
I:0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	Bul.1763	MicroLogix	1100	Series A-Analog

**Main**

Processor Mode S:1/0 - S:1/4 = Remote Run  
On Power up Go To Run (Mode Behavior) S:1/12 = 0  
First Pass S:1/15 = No  
Free Running Clock S:4 = 0111-0110-1011-0000

**Proc**

OS Catalog Number S:57 = 1100                      User Program Type S:63 = 8001h  
OS Series S:58 = B                                  Compiler Revision Number S:64 =  
OS FRS S:59 =  
Processor Catalog Number S:60 =  
Processor Series S:61 = A  
Processor FRN S:62 =

**Scan Times**

Maximum (x10 ms) S:22 = 524  
Watchdog (x10 ms) S:3 (high byte) = 10  
Last 100 uSec Scan Time S:35 = 507  
Scan Toggle Bit S:33/9 = 0

**Math**

Math Overflow Selected S:2/14 = 1                      Math Register (lo word) S:13 = 0  
Overflow Trap S:5/0 = 0                              Math Register (high word) S:14-S:13 = 0  
Carry S:0/0 = 0                                      Math Register (32 Bit) S:14-S:13 = 0  
Overflow S:0/1 = 0  
Zero Bit S:0/2 = 1  
Sign Bit S:0/3 = 0

**Chan 0**

Processor Mode S:1/0- S:1/4 = Remote Run  
Node Address S:15 (low byte) = 0                      Outgoing Msg Cmd Pending S:33/2 = 0  
Baud Rate S:15 (high byte) = ?  
Channel Mode S:33/3 = 0  
Comms Active S:33/4 = 0  
Incoming Cmd Pending S:33/0 = 0  
Msg Reply Pending S:33/1 = 0

**Debug**

Suspend Code S:7 = 0  
Suspend File S:8 = 0

**Errors**

Fault Override At Power Up S:1/8 = 0                      Fault Routine S:29 = 0  
Startup Protection Fault S:1/9 = 0                      Major Error S:6 = 0h  
Major Error Halt S:1/13 = 0  
Overflow Trap S:5/0 = 0                              Error Description:  
Control Register Error S:5/2 = 0  
Major Error Executing User Fault Rtn. S:5/3 = 0  
Battery Low S:5/11 = 0  
Input Filter Selection Modified S:5/13 = 0  
ASCII String Manipulation error S:5/15 = 0

**Protection**

Deny Future Access S:1/14 = No  
Data File Overwrite Protection Lost S:36/10 = True

**Mem Module**

Memory Module Loaded On Boot S:5/8 = 0  
Password Mismatch S:5/9 = 0  
Load Memory Module On Memory Error S:1/10 = 0  
Load Memory Module Always S:1/11 = 0  
On Power up Go To Run (Mode Behavior) S:1/12 = 0  
Program Compare S:2/9 = 0  
Data File Overwrite Protection Lost S:36/10 = 1



**Forces**

Forces Enabled S:1/5 = Yes  
Forces Installed S:1/6 = No

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol)	Description
B3:0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Offset	EN	TT	DN	BASE	PRE	ACC	(Symbol)	Description
T4:0	0	0	0	1.0 sec	600	0	(DELAY LEAD OFF 10MIN)	
T4:1	0	0	0	1.0 sec	15	0	(DELAY_LAG1_ON_15S)	
T4:2	0	0	0	1.0 sec	60	0	(DELAY_LAG1_OFF_1MIN)	
T4:3	0	0	0	1.0 sec	60	0	(DELAY_LAG2_OFF_1MIN)	

Offset	CU	CD	DN	OV	UN	UA	PRE	ACC	(Symbol)	Description
C5:0	0	0	0	0	0	0	0	0		

Offset	EN	EU	DN	EM	ER	UL	IN	FD	LEN	POS	(Symbol)	Description
R6:0	0	0	0	1	0	0	0	0	128	0		

Data File N7 (dec) -- INTEGER

Offset	0	1	2	3	4	5	6	7	8	9
N7:0	0									

Offset	0	1	2	3	4
F8:0	0				

Data File N200 (dec) -- MISC\_INTS

Offset	0	1	2	3	4	5	6	7	8	9
N200:0	0									



Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol)	Description
B235:0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Data File L244 (dec)	--	ONTMMINMAX	--	Maximum and minimum ON times for pumps in Auto
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Offset	0	1	2	3	4
L244:0	0	0	0	300	

Data File L245 (dec)	--	ONTM_LONGS	--	Cumulative scan times and ON times for pumps
----------------------	----	------------	----	--

Offset	0	1	2	3	4
L245:0	0	0	0	0	0
L245:5	0				

Data File N254 (dec)	--	BIT_COUNTS	--	Number of 1-bits for each INT value [0:7]
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Offset	0	1	2	3	4	5	6	7	8	9
N254:0	0	1	1	2	1	2	2	3		

Data	File	N255	(dec)	--	MANAUTOMNT	--	Manual/Auto/Maintenance	states	of	pumps
------	------	------	-------	----	------------	----	-------------------------	--------	----	-------

Offset	0	1	2	3	4	5	6	7	8	9
N255:0	0	0	0	0	0	0	0	0	0	0
N255:10	0	0	0	0						

## Address/Symbol Database

Address	Symbol	Scope	Description	Sym
B3:0/0	ALWAYS_FALSE	Global		
B3:0/1				
B3:0/15	SKIP_INPUT_MAP	Global		
B235:0/0	PUMP_1_ON	Global		
B235:0/1	PUMP_2_ON	Global		
B235:0/2	PUMP_3_ON	Global		
B235:0/3	PUMP_1_IS_LEAD	Global		
B235:0/4	PUMP_2_IS_LEAD	Global		
B235:0/5	PUMP_3_IS_LEAD	Global		
B235:0/6	PUMP_1_IS_LAG1	Global		
B235:0/7	PUMP_2_IS_LAG1	Global		
B235:0/8	PUMP_3_IS_LAG1	Global		
B235:0/9	PUMP_1_IS_LAG2	Global		
B235:0/10	PUMP_2_IS_LAG2	Global		
B235:0/11	PUMP_3_IS_LAG2	Global		
B235:0/12	LEAD_ON	Global		
B235:0/13	LAG1_ON	Global		
B235:0/14	LAG2_ON	Global		
B235:0/15	DO_RESEQUENCE	Global		
L244:0	MAX_ON_TIME_AUTO	Global		
L244:1	MIN_ON_TIME_AUTO	Global		
L244:2	ONTIM_TO_RESEQUENCE	Global		
L244:3	ONTM_RESEQ_TRIGGER	Global	When Auto (max-min) on-time reaches this level, resequence	
L245:0	PUMP_1_ON_SCANS	Global		
L245:0/10	PUMP_1_2048_SCANS	Global		
L245:1	PUMP_2_ON_SCANS	Global		
L245:1/10	PUMP_2_2048_SCANS	Global		
L245:2	PUMP_3_ON_SCANS	Global		
L245:2/10	PUMP_3_2048_SCANS	Global		
L245:3	PUMP_1_ON_TIME	Global		
L245:4	PUMP_2_ON_TIME	Global		
L245:5	PUMP_3_ON_TIME	Global		
N7:0				
N7:1			Mask Result	
N7:1/15				
N7:1/[N7:4]				
N7:1/[N7:5]				
N7:2	BITS_TO_SHIFT_RIGHT	Global		
N7:3	DIVISOR	Global		
N7:4	SHIFTED_SIGN_BIT_POS	Global		
N7:4/[N7:2]				
N7:7/15				
N7:8/15				
N254:0			0=000b; zero 1-bits	
N254:1			1=001b; one 1-bit	
N254:2			2=010b; one 1-bit	
N254:3			3=011b; two 1-bits	
N254:4			4=100b; one 1-bit	
N254:5			5=101b; two 1-bits	
N254:6			6=110b; two 1-bits	
N254:7			7=111b; three 1-bits	
N254:[N255:0]				
N254:[N255:1]				
N255:0	MNT_PUMP_BITS	Global		
N255:0/0	MNT_PUMP_1_BIT	Global		
N255:0/1	MNT_PUMP_2_BIT	Global		
N255:0/2	MNT_PUMP_3_BIT	Global		
N255:1	MAN_PUMP_BITS	Global		
N255:1/0	MAN_PUMP_1_BIT	Global		
N255:1/1	MAN_PUMP_2_BIT	Global		
N255:1/2	MAN_PUMP_3_BIT	Global		
N255:2	AUT_PUMP_BITS	Global		
N255:2/0	AUT_PUMP_1_BIT	Global		
N255:2/1	AUT_PUMP_2_BIT	Global		
N255:2/2	AUT_PUMP_3_BIT	Global		
N255:3	MNT_BITS_SAVED	Global		
N255:4	MAN_BITS_SAVED	Global		
N255:5	AUT_BITS_SAVED	Global		
N255:6	MNT_COUNT	Global		
N255:7	MAN_COUNT	Global		
N255:8	AUT_COUNT	Global		
N255:10	MNT_MAN_AUT_INPUTMAP	Global		
N255:10/0	MANUAL_PUMP_1_INP	Global		
N255:10/1	AUTOMATIC_PUMP_1_INP	Global		
N255:10/2	MANUAL_PUMP_2_INP	Global		
N255:10/3	AUTOMATIC_PUMP_2_INP	Global		
N255:10/4	MANUAL_PUMP_3_INP	Global		
N255:10/5	AUTOMATIC_PUMP_3_INP	Global		
N255:11	DISPOS_BUOY_INPUTMAP	Global		
N255:11/0	DISP_BUOY_TANK1_INP	Global		
N255:11/1	DISP_BUOY_TANK2_INP	Global		
N255:12	BLOCK_BUOY_INPUTMAP	Global		
N255:12/0	BLOCK_BUOY_TANK1_INP	Global		
N255:12/1	BLOCK_BUOY_TANK2_INP	Global		

## Address/Symbol Database

Address	Symbol	Scope	Description	Sym
N255:13	VACUOSTAT_INPUTMAP	Global		
N255:13/0	VACUOSTAT_GT_18_INP	Global		
N255:13/1	VACUOSTAT_GT_15_INP	Global		
R6:[N7:0]				
S:0			Arithmetic Flags	
S:0/0			Processor Arithmetic Carry Flag	
S:0/1			Processor Arithmetic Underflow/ Overflow Flag	
S:0/2			Processor Arithmetic Zero Flag	
S:0/3			Processor Arithmetic Sign Flag	
S:1			Processor Mode Status/ Control	
S:1/0			Processor Mode Bit 0	
S:1/1			Processor Mode Bit 1	
S:1/2			Processor Mode Bit 2	
S:1/3			Processor Mode Bit 3	
S:1/4			Processor Mode Bit 4	
S:1/5			Forces Enabled	
S:1/6			Forces Present	
S:1/7			Comms Active	
S:1/8			Fault Override at Powerup	
S:1/9			Startup Protection Fault	
S:1/10			Load Memory Module on Memory Error	
S:1/11			Load Memory Module Always	
S:1/12			Load Memory Module and RUN	
S:1/13			Major Error Halted	
S:1/14			Access Denied	
S:1/15			First Pass	
S:2/0			STI Pending	
S:2/1			STI Enabled	
S:2/2			STI Executing	
S:2/3			Index Addressing File Range	
S:2/4			Saved with Debug Single Step	
S:2/5			DH-485 Incoming Command Pending	
S:2/6			DH-485 Message Reply Pending	
S:2/7			DH-485 Outgoing Message Command Pending	
S:2/15			Comms Servicing Selection	
S:3			Current Scan Time/ Watchdog Scan Time	
S:4			Time Base	
S:5/0			Overflow Trap	
S:5/2			Control Register Error	
S:5/3			Major Err Detected Executing UserFault Routine	
S:5/4			M0-M1 Referenced on Disabled Slot	
S:5/8			Memory Module Boot	
S:5/9			Memory Module Password Mismatch	
S:5/10			STI Overflow	
S:5/11			Battery Low	
S:6			Major Error Fault Code	
S:7			Suspend Code	
S:8			Suspend File	
S:9			Active Nodes	
S:10			Active Nodes	
S:11			I/O Slot Enables	
S:12			I/O Slot Enables	
S:13			Math Register	
S:14			Math Register	
S:15			Node Address/ Baud Rate	
S:16			Debug Single Step Rung	
S:17			Debug Single Step File	
S:18			Debug Single Step Breakpoint Rung	
S:19			Debug Single Step Breakpoint File	
S:20			Debug Fault/ Powerdown Rung	
S:21			Debug Fault/ Powerdown File	
S:22			Maximum Observed Scan Time	
S:23			Average Scan Time	
S:24			Index Register	
S:25			I/O Interrupt Pending	
S:26			I/O Interrupt Pending	
S:27			I/O Interrupt Enabled	
S:28			I/O Interrupt Enabled	
S:29			User Fault Routine File Number	
S:30			STI Setpoint	
S:31			STI File Number	
S:32			I/O Interrupt Executing	
S:33			Extended Proc Status Control Word	
S:33/0			Incoming Command Pending	
S:33/1			Message Reply Pending	
S:33/2			Outgoing Message Command Pending	
S:33/3			Selection Status User/DFI	
S:33/4			Communicat Active	
S:33/5			Communicat Servicing Selection	
S:33/6			Message Servicing Selection Channel 0	
S:33/7			Message Servicing Selection Channel 1	
S:33/8			Interrupt Latency Control Flag	
S:33/9			Scan Toggle Flag	
S:33/10			Discrete Input Interrupt Reconfigur Flag	

## Address/Symbol Database

Address	Symbol	Scope	Description	Sym
S:33/11			Online Edit Status	
S:33/12			Online Edit Status	
S:33/13			Scan Time Timebase Selection	
S:33/14			DTR Control Bit	
S:33/15			DTR Force Bit	
S:34			Pass-thru Disabled	
S:34/0			Pass-Thru Disabled Flag	
S:34/1			DH+ Active Node Table Enable Flag	
S:34/2			Floating Point Math Flag Disable,Fl	
S:35			Last 1 ms Scan Time	
S:36			Extended Minor Error Bits	
S:36/8			DII Lost	
S:36/9			STI Lost	
S:36/10			Memory Module Data File Overwrite Protection	
S:37			Clock Calendar Year	
S:38			Clock Calendar Month	
S:39			Clock Calendar Day	
S:40			Clock Calendar Hours	
S:41			Clock Calendar Minutes	
S:42			Clock Calendar Seconds	
S:43			STI Interrupt Time	
S:44			I/O Event Interrupt Time	
S:45			DII Interrupt Time	
S:46			Discrete Input Interrupt- File Number	
S:47			Discrete Input Interrupt- Slot Number	
S:48			Discrete Input Interrupt- Bit Mask	
S:49			Discrete Input Interrupt- Compare Value	
S:50			Processor Catalog Number	
S:51			Discrete Input Interrupt- Return Number	
S:52			Discrete Input Interrupt- Accumulat	
S:53			Reserved/ Clock Calendar Day of the Week	
S:55			Last DII Scan Time	
S:56			Maximum Observed DII Scan Time	
S:57			Operating System Catalog Number	
S:58			Operating System Series	
S:59			Operating System FRN	
S:61			Processor Series	
S:62			Processor Revision	
S:63			User Program Type	
S:64			User Program Functional Index	
S:65			User RAM Size	
S:66			Flash EEPROM Size	
S:67			Channel 0 Active Nodes	
S:68			Channel 0 Active Nodes	
S:69			Channel 0 Active Nodes	
S:70			Channel 0 Active Nodes	
S:71			Channel 0 Active Nodes	
S:72			Channel 0 Active Nodes	
S:73			Channel 0 Active Nodes	
S:74			Channel 0 Active Nodes	
S:75			Channel 0 Active Nodes	
S:76			Channel 0 Active Nodes	
S:77			Channel 0 Active Nodes	
S:78			Channel 0 Active Nodes	
S:79			Channel 0 Active Nodes	
S:80			Channel 0 Active Nodes	
S:81			Channel 0 Active Nodes	
S:82			Channel 0 Active Nodes	
S:83			DH+ Active Nodes	
S:84			DH+ Active Nodes	
S:85			DH+ Active Nodes	
S:86			DH+ Active Nodes	
T4:0	DELAY LEAD OFF_10MIN	Global		
T4:0/DN	LEAD_OFF_DELAY_DONE	Global		
T4:1	DELAY_LAG1_ON_15S	Global		
T4:1/DN	LAG1_ON_DELAY_DONE	Global		
T4:2	DELAY_LAG1_OFF_1MIN	Global		
T4:2/DN	LAG1_OFF_DELAY_DONE	Global		
T4:3	DELAY_LAG2_OFF_1MIN	Global		
T4:3/DN	LAG2_OFF_DELAY_DONE	Global		
U:215	INPUT_MAP	Global	Copy discrete input values to N255	
U:225	ON_OFF_SEQ_TYPES	Global	Determine which sequence types are on or off	
U:234	LEAD_LAG1_LAG2	Global	Assign sequence types to pumps	
U:235	ON_OFF_PUMPS	Global	Determine which pumps are on or off	
U:244	MIN_MAX_ON_TIMES_AUT	Global	Calculate minimum and maximum ON times for pumps in Automatic mode	
U:245	ACCUMULATE_ON_TIMES	Global	Accumulate ON times, i.e. runtimes, for all pumps	
U:255	MAN_AUTO_MAINT	Global	Assign which pumps are in Manual mode or Automatic mode or Maintenance mode	



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Address	Instruction	Description
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Group_Name	Description
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