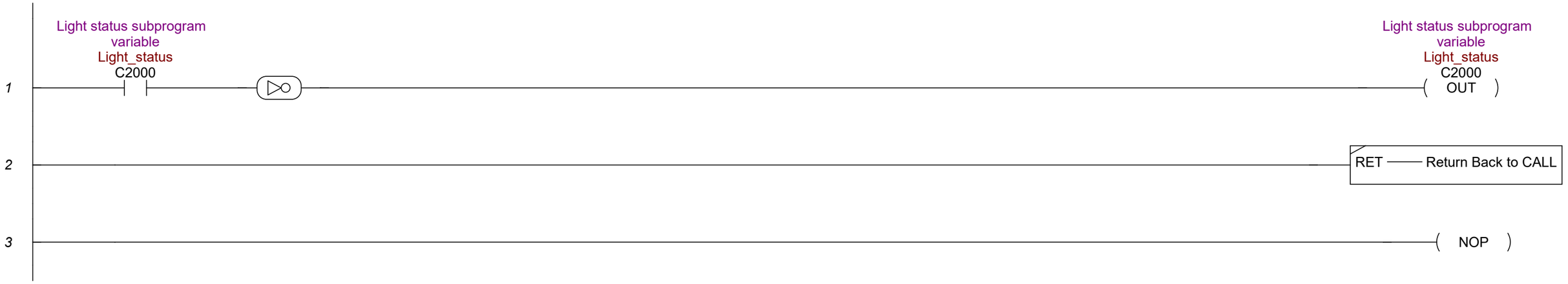

Light status subprogram
variable
Light_status
C2000
Light status subprogram
variable
Light_status
C2000
OUT
1
2
RET
Return Back to CALL
3
NOP

1

$FirstScan
ST0

$On
ST1

INIT — Initialize Data

Start	End	Value
Overcurrent_lim		75
Dome_move_tout		165000
curr_delay_val		2000
Dome_enable		0
Motor_dir		1
HB_error_count		0
Remote_estop		0
Remote_estop_rel		0
date.Date		$Now.Date
date.Time		$Now.Time
UTC		$UTC
C0		0
Rain_mod		0
Rain_el_time		0
No_rain_cdown		0
Drive_speed_a		100
Drive_speed_b		70
Roof_logic_sel		1
Rolloff_lout	Drive_err_rst_mo	0
Tout_open		81000
Tout_open_aprch		37000
Topen_apr		28000
Tclose		74000
Tout_close_apr		44000

Control room lights current sensor input
Local S1:iPT8
Ctl_lights_in
X24

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Ctl_lights_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Ctl_lights_out	1

Utilities room lights current sensor input
Local S1:iPT9
Utl_room_in
X25

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Utl_lights_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Utl_lights_out	1

Spectrograph room lights current sensor input
Local S1:iPT10
Spec_lights_in
X26

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Spec_lights_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Spec_lights_out	1

Mezzanine lights current sensor input
Local S1:iPT11
Mze_lights_in
X27

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Mze_lights_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Mze_lights_out	1

Platform white light current sensor input
Local S1:iPT12
Plat_Wlights_in
X28

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Plat_Wlight_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Plat_Wlight_out	1

Platform red light current sensor input
Local S1:iPT13
Plat_Rlights_in
X29

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Plat_Rlight_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Plat_Rlight_out	1

Read GS3 drive Elements using the cpu rs-232 port

2

500 ms timer
timer_500ms.Done
T10.Done

MRX — Modbus Network Read

Device	@IntSerModbusClient
Unit ID	1
Function Code	3 - Read Holding Registers
Modbus Address 4… + offset value entered below	
From Modbus Offset Address	8449
Number of Modbus Registers	8
To Do-more Memory Address	Status_1
Do-more Range	Status_1 - VDF_output_RPM
On Success, Set bit	C100
On Error, Set bit	C200

COPY — Copy Data

#	Source	Destination	Count
1	Output_current	Im_copy	1

Deprecated status 2 only read

3

500 ms timer
timer_500ms.Done
T10.Done

$Off
ST2

MRX — Modbus Network Read

Device	@IntSerModbusClient
Unit ID	1
Function Code	3 - Read Holding Registers
Modbus Address 4… + offset value entered below	
From Modbus Offset Address	8450
Number of Modbus Registers	1
To Do-more Memory Address	Status_2
Do-more Range	Status_2
On Success, Set bit	C101
On Error, Set bit	C201

Copy the encoder counts output to MHR150

- If motor is not moving, send data every minute.
- If motor is moving, send data every second.

4

GS3 drive movement
transitioning state
Modbus 40412
Status_2:0
MHR412:0

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

$1Minute
ST3

$Dome_encoder.Reset

COPY — Copy Data

#	Source	Destination	Count
1	0	Dome_speed	1

COPY — Copy Data

#	Source	Destination	Count
1	0	Dome_enc_count	1
2	0	Dome_enc_scale	1

GS3 drive movement
transitioning state
Modbus 40412
Status_2:0
MHR412:0

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

$1Second
ST4

$Dome_encoder.Reset

$Dome_encoder.iReg1 ≥ 0

MATH — Calculate Expression

Roll off speed scaled to mm
Modbus 40152
Dome_speed

Result MHR152
Expression (ABS($Dome_encoder.iReg1 - Dome_enc_count) * 9525) / 10850

$Dome_encoder.Reset

C6
SET

5

C6 $Dome_encoder.iReg1 ≥ 0

COPY — Copy Data

#	Source	Destination	Count
1	$Dome_encoder.iReg1	Dome_enc_count	1

SCALE — Scale Value

Input	$Dome_encoder.iReg1
In Min	0
In Max	10783
Out Min	0
Out Max	9525
Output	Dome_enc_scale

C6 RST

6

Dome status closed
Modbus 00109
Dome_closed
MC109 $Dome_encoder.iReg1 ≠ 0 $Dome_encoder.iReg1 ≤ 30

$Dome_encoder.Reset SET

7

$Dome_encoder.Reset $Dome_encoder.iReg1 = 0

$Dome_encoder.Reset RST

Read ODH variables for sensor 2 through Serio-4 every 2 seconds.

8

$1Second
ST4

MRX — Modbus Network Read

Device	@ODH
Unit ID	1
Function Code	3 - Read Holding Registers
	Modbus Address 4… + offset value entered below
From Modbus Offset Address	202
Number of Modbus Registers	5
To Do-more Memory Address	O2_pct_spec_in
Do-more Range	O2_pct_spec_in - ODH_SB_spec_in
On Success, Set bit	C102
On Error, Set bit	C202

C600 RST

MOVE — Move Value

ODH O2 concentration of
the utilities room in percent
decimal read from ODH
sensor
O2_pct_utl_in

Source	V600
Destination	O2_pct_utl_room

MOVE — Move Value

ODH error code utilities
room read from ODH sensor
ODH_EC_utl_in

Source	V603
Destination	ODH_EC_utl_room

MOVE — Move Value
ODH status byte utilities room, read from ODH sensor ODH_SB_utl_in
Source V604
Destination ODH_SB_utl_room

Read ODH variables for sensor 1 through Serio-4 every 2 seconds.

9 $1Second ST4

MRX — Modbus Network Read
Device @ODH
Unit ID 1
Function Code 3 - Read Holding Registers
Modbus Address 4… + offset value entered below
From Modbus Offset Address 102
Number of Modbus Registers 5
To Do-more Memory Address O2_pct_utl_in
Do-more Range O2_pct_utl_in - ODH_SB_utl_in
On Success, Set bit C103
On Error, Set bit C203

C600 SET

MOVE — Move Value
ODH O2 concentration of the spectrograph room in percent decimal, read from ODH sensor O2_pct_spec_in
Source V605
Destination O2_pct_spec_room

MOVE — Move Value
ODH error code spectrograph room, read from ODH sensor ODH_EC_spec_in
Source V608
Destination ODH_EC_spec_room

MOVE — Move Value
ODH status byte spectrograph room, read from ODH sensor ODH_SB_spec_in
Source V609
Destination ODH_SB_spec_room

10 $1Second ST4

MATH — Calculate Expression
Modbus 40700 Rain_el_time
Result MHR700
Expression TRUNC(Rain_elapsd_time.Acc / 1000)

MATH — Calculate Expression
Countdown from 15 min with no rain
Modbus 40701
No_rain_cdown
Result MHR701
Expression TRUNC(Rain_time.Acc / 1000)

11

Dome movement mode selector: selects between normal operation and overcurrent only mode.
Modbus 00099
Dome_move_sel
MC99

$On
ST1

RUN — Run Program
Drive subprogram (Deprecated)
Program Drive

HALT — Halt Program or Task
Code Block Drive_new

Dome movement mode selector: selects between normal operation and overcurrent only mode.
Modbus 00099
Dome_move_sel
MC99

RUN — Run Program
Program Drive_new

HALT — Halt Program or Task
Drive subprogram (Deprecated)
Code Block Drive

12

$On
ST1

RUN — Run Program
Rain sensor program
Program Rain

RUN — Run Program
Program NTP

RUN — Run Program
Program Heartbeat_new

13

Local GS3 control activated
Modbus 40412
Local_GS3_op
MHR412:10

Telescope platform on local mode
Modbus 00003
Local_enable
MC3
OUT

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902

Local S1:iPT0
Door_locked_in
X16

Local S1:iPT2
Door_closed_in
X18

14

Local S1:iPT0
Door_locked_in
X16

Door magnetic lock engaged
Modbus 00001
Door_locked
MC1
OUT

15

Local S1:iPT2
Door_closed_in
X18

Door close sensor activated
Modbus 00002
Door_closed
MC2
OUT

16

Modbus control room lights toggle
Modbus 00235
CTL_room_tog
MC235

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Ctl_lights_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Ctl_lights_out	1

Modbus control room lights toggle
Modbus 00235
CTL_room_tog
MC235
RST

17

Control room lights current sensor input
Local S1:iPT8
Ctl_lights_in
X24

Modbus utilities room lights status
Modbus 00335
CTL_room_stat
MC335
OUT

18

Modbus utilities room lights toggle
Modbus 00236
UTL_room_tog
MC236

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Utl_lights_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Utl_lights_out	1

Modbus utilities room lights toggle
Modbus 00236
UTL_room_tog
MC236
RST

19

Utilities room lights current sensor input
Local S1:iPT9
Utl_room_in
X25

Modbus utilities room lights status
Modbus 00336
UTL_room_stat
MC336
OUT

20

Modbus Spectrograph room lights toggle
Modbus 00237
Spec_room_tog
MC237

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Spec_lights_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Spec_lights_out	1

COPY — Copy Data

#	Source	Destination	Count
1	$UTC	UTC	1

C0
RST

Modbus Spectrograph room lights toggle
Modbus 00237
Spec_room_tog
MC237
RST

21

Spectrograph room lights current sensor input
Local S1:iPT10
Spec_lights_in
X26

Modbus spectrograph room lights status
Modbus 00337
Spec_room_stat
MC337
OUT

22

Modbus mezzanine room lights toggle
Modbus 00238
Mze_room_tog
MC238

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Mze_lights_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Mze_lights_out	1

Modbus mezzanine room lights toggle
Modbus 00238
Mze_room_tog
MC238
RST

23

Mezzanine lights current sensor input
Local S1:iPT11
Mze_lights_in
X27

Modbus mezzanine room lights status
Modbus 00338
Mze_room_stat
MC338
OUT

24

Modbus roll-off white light toggle
Modbus 00239
Plat_wlight_tog
MC239

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Plat_Wlight_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Plat_Wlight_out	1

Modbus roll-off white light toggle
Modbus 00239
Plat_wlight_tog
MC239
RST

25

Platform white light current sensor input
Local S1:iPT12
Plat_WIights_in
X28

Modbus roll-off white light status
Modbus 00339
Plat_wlight_stat
MC339
OUT

26

Modbus roll-off red light toggle
Modbus 00240
Plat_rlight_tog
MC240

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Plat_Rlight_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Plat_Rlight_out	1

Modbus roll-off red light toggle
Modbus 00240
Plat_rlight_tog
MC240
RST

27

Platform red light current sensor input
Local S1:iPT13
Plat_RIights_in
X29

Modbus roll-off red light status
Modbus 00340
Plat_rlight_stat
MC340
OUT

28

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902

Platform white light current sensor input
Local S1:iPT12
Plat_WIights_in
X28

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Plat_Wlight_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Plat_Wlight_out	1

Platform red light current sensor input
Local S1:iPT13
Plat_Rlights_in
X29

CALL — Call Subroutine

Subroutine: Lights

Optional Input Parameters

#	Input Value	Into Subroutine	Count
1	Plat_Rlight_out	Light_status	1

Optional Output Parameters

#	Out of Subroutine	Into	Count
1	Light_status	Plat_Rlight_out	1

29

North-eastt limit switch input
Local S1:iPT20
LS_NE_in
X36

North-east LS modbus output
Modbus 00105
NE_lim_mod
MC105
OUT

30

South-east limit switch input
Local S1:iPT22
LS_SE_in
X38

South-east LS modbus output
Modbus 00106
SE_lim_mod
MC106
OUT

31

North-west limit switch input
Local S1:iPT16
LS_NW_in
X32

North-west LS modbus output
Modbus 00107
NW_lim_mod
MC107
OUT

32

South-west limit switch input
Local S1:iPT18
LS_SW_in
X34

South-west LS modbus output
Modbus 00108
SW_lim_mod
MC108
OUT

33

North-eastt limit switch input
Local S1:iPT20
LS_NE_in
X36

Dome status open
Modbus 00110
Dome_open
MC110

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

$Dome_encoder.iReg1 ≤ 18

Dome status closed
Modbus 00109
Dome_closed
MC109
OUT

North-west limit switch input
Local S1:iPT16
LS_NW_in
X32

34

South-east limit switch input
Local S1:iPT22
LS_SE_in
X38

South-west limit switch input
Local S1:iPT18
LS_SW_in
X34

Dome status closed
Modbus 00109
Dome_closed
MC109

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

$Dome_encoder.iReg1 ≥ 10750

Dome status open
Modbus 00110
Dome_open
MC110
OUT

HVAC Flag to activate telescope platforms inyectors.

Fans will be turned on, if signal is off.

Fans should be turned off, if dome is open (not closed) or local enebeled.

35

Dome status closed
Modbus 00109
Dome_closed
MC109

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Flag to stop telescope platform fans
Local S0:oPT8
HVAC_flag
Y8
OUT

36

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

E-stop status, read on the secondary electrical panel
Modbus 00200
Estop_stat_mbus
MC200
OUT

Remote E-stop
Modbus 00201
Remote_estop
MC201
RST

37

Remote E-stop
Modbus 00201
Remote_estop
MC201

PLC e-stop output
Local S0:oPT14
PLC_Estop
Y14
OUT

38

Remote E-stop reset
Modbus 00202
Remote_estop_rel
MC202

PLC reset e-stop output
Local S0:oPT13
PLC_Estop_releas
Y13
OUT

39
Remote E-stop reset
Modbus 00202
Remote_estop_rel
MC202
Shows if E-stop is active
Local S1:iPT24
Estop_status
X40
E/R
TMR — Timer
E-stop reset timer
Estop_rst_timer
Timer Struct T12
Preset 1.000s

40
E-stop reset timer
Estop_rst_timer.Done
T12.Done
Remote E-stop reset
Modbus 00202
Remote_estop_rel
MC202
RST

41
C5
STRPRINT — Print to String
Modbus variables sent to
DMLOGGER
DMLOG_MOD_OUT
Print to SL1
No space separator
Print Script "#file:" Log_Filename "#" $UTC " "
DMLOG_new_read "$0D$0A"
STRCOPY — Copy String
Modbus variables new
reading for dmlogger output
DMLOG_new_read
Source SL0
Destination DMLOG_saved_read
Count 1
C9
SET

42
C9
STREAMOUT — Stream Out Data to Device
Device @DMLogger
String Stream DMLOG_MOD_OUT
On Success, Set bit C3
On Error, Set bit C4
C9
RST

43 $On ST1

STRPRINT — Print to String
Modbus variables new reading for dmlogger output DMLOG_new_read
Print to SL0
Space separator inserted
Print Script Door_locked Door_closed Local_enable Dome_move_sel Dome_enable MC101 Motor_dir Dome_Tout_stat NE_lim_mod SE_lim_mod NW_lim_mod SW_lim_mod Dome_closed Dome_open Rolloff_lout Rolloff_error Estop_stat_mbus Remote_estop Remote_estop_rel CTL_room_tog UTL_room_tog Spec_room_tog Mze_room_tog Plat_wlight_tog Plat_rlight_tog CTL_room_stat UTL_room_stat Spec_room_stat Mze_room_stat Plat_wlight_stat Plat_rlight_stat HB_input HB_ACK HB_err_out Internet_disable Rain_mod Eng_hw_mode_mod Eng_sw_mode_mod Eng_hw_mode Eng_sw_mode Dome_enc_count Dome_speed Status_1 Status_2 VDF_des_freq VDF_out_freq Output_current VDF_output_volt VDF_output_RPM O2_pct_utl_room ODH_EC_utl_room rain_sen_in Brake_start

STRCMP — String Compare
Modbus variables to be checked against at next cycle DMLOG_saved_read
First String SL3
Case Sensitive Yes, upper/lower case are different
Set If Equal C5
Second String or Text DMLOG_new_read

44 $100ms ST5

DTCMP — Compare Date/Time
date
First Date/Time UDT0
Second Date/Time UDT1
Compare Date Only
Set if First Equals Second C10

EPOCH2DT — Convert Epoch to Date/Time
$UTC
1970 Epoch DST21
Date/Time UDT1

45 C10

EPOCH2DT — Convert Epoch to Date/Time
$UTC
1970 Epoch DST21
Date/Time date

C11 SET

46
C11

STRPRINT — Print to String
DMlogger log filename
Log_Filename
Print to SL2
No space separator
Print Script "C:\logs\" date.Year "_" date.Month "_" date.Day ".txt"

C11
RST

47
C1
C2

STRPRINT — Print to String
SMTP_Error
Print to SL4
No space separator
Print Script "#file:C:\logs\smtp.log#" $UTC " " MSG " " ERR "$0D$0A"

Sends information to dmlogger when smpt message is sent
SMTP_log
C7
SET

C1
RST

C2
RST

Sends information to dmlogger when smpt message is sent
SMTP_log
48
C7

STREAMOUT — Stream Out Data to Device
Device @DMLogger
String Stream SMTP_Error
On Success, Set bit C8
On Error, Set bit C12

Sends information to dmlogger when smpt message is sent
SMTP_log
C7
RST

49
C0

MATH — Calculate Expression
Result C0
Expression $UTC >= (UTC + 3)

Send an email when the lights of the spectrograph room are turned on manualy

50

Modbus Spectrograph room lights toggle
Modbus 00237
Spec_room_tog
MC237

Spectrograph room lights current sensor input
Local S1:iPT10
Spec_lights_in
X26

C0

Disables software safety features
Modbus 00903
Eng_sw_mode
MC903

EMAIL — Send EMail

SMTP Device @LCO_smtp
To "lvm-critical@sdss.org"
Subject "Someone entered the Spectrograph room"
No space separator
Message Print Script "Someone turned on the lights on the spectrograph room at " $Now.Day "/" $Now.Month "/" $Now.Year " " $Now.Hour ":" $Now.Minute " Local time."
On Success, Set bit C1
On Error, Set bit C2

Send an email when the lights of the spectrograph room are turned off manually

51

Modbus Spectrograph room lights toggle
Modbus 00237
Spec_room_tog
MC237

Spectrograph room lights current sensor input
Local S1:iPT10
Spec_lights_in
X26

C0

Disables software safety features
Modbus 00903
Eng_sw_mode
MC903

EMAIL — Send EMail

SMTP Device @LCO_smtp
To "lvm-critical@sdss.org"
Subject "Someone left the Spectrograph room"
No space separator
Message Print Script "Someone turned off the lights on the spectrograph room at " $Now.Day "/" $Now.Month "/" $Now.Year " " $Now.Hour ":" $Now.Minute " Local time."
On Success, Set bit C1
On Error, Set bit C2

52

500 ms timer
timer_500ms.Done
T10.Done

TMR — Timer
500 ms timer
timer_500ms
E/R
Timer Struct T10
Preset 0.500s

Define day change for warning error changes.

For example, if the coin battery dies.

53

$1Minute
ST3

COPY — Copy Data

#	Source	Destination	Count
1	$Now.Day	V0	1

Send e-mail to lvm critical, if battery is low.

54

$BatteryLow
ST149

STRPRINT — Print to String

Print to SS0
Space separator inserted
Print Script "Coin cell battery has been depleted since " $Now.Day "/" $Now.Month "/" $Now.Year ". Please replace it with a 2032 coin cell battery."

EMAIL — Send EMail
SMTP Device @LCO_smtp
To "lvm-critical@sdss.org"
Subject "Replace plc battery"
No space separator
Message Print Script "Coin cell battery has been depleted " $Now.Day "/" $Now.Month "/" $Now.Year ". Please replace it with a 2032 coin cell battery."
On Success, Set bit C1
On Error, Set bit C2

COPY — Copy Data

#	Source	Destination	Count
1	$Now	UDT1	1

Resend battery e-mail every day at midnight

55

$BatteryLow ST149 — $Now.Day V0 SDT0.Day

EMAIL — Send EMail
SMTP Device @LCO_smtp
To "lvm-critical@sdss.org"
Subject "Replace plc battery"
No space separator
Message Print Script "Coin cell battery has been depleted since " UDT1.Day "/" UDT1.Month "/" UDT1.Year ". Please replace it with a 2032 coin cell battery."
On Success, Set bit C1
On Error, Set bit C2

56

Physical switch disables hardware safety features
Local S1:iPT29
Eng_hw_mode_phy
X45

Modbus Disables hardware safety features
Modbus 00900
Eng_hw_mode_mod
MC900

Physical switch disables hardware safety features
Local S1:iPT29
Eng_hw_mode_phy
X45

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902
OUT

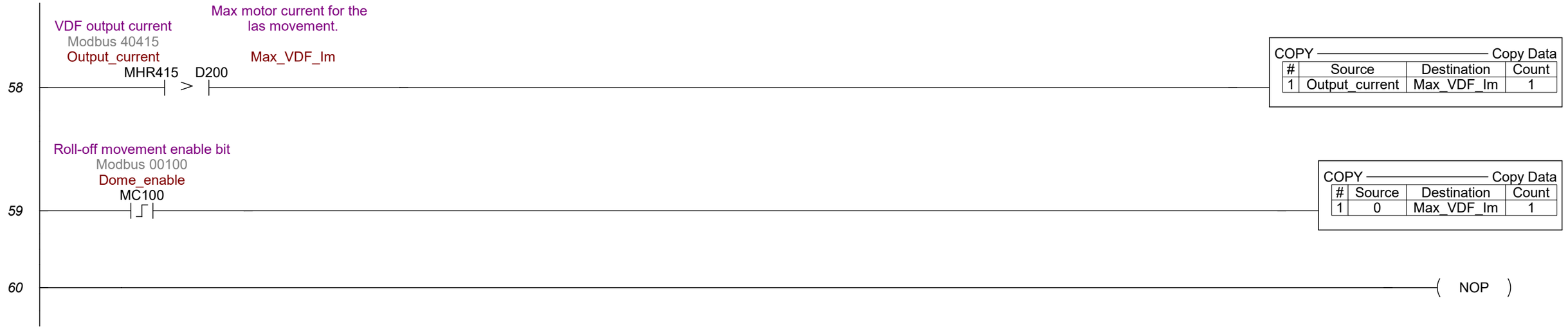
57

Physical switch disables software safety features
Local S1:iPT28
Eng_sw_mode_phy
X44

Modbus Disables software safety features
Modbus 00901
Eng_sw_mode_mod
MC901

Physical switch disables software safety features
Local S1:iPT28
Eng_sw_mode_phy
X44

Disables software safety features
Modbus 00903
Eng_sw_mode
MC903
OUT


Max motor current for the las movement.
VDF output current
Modbus 40415
Output_current
Max_VDF_Im
MHR415
D200
>
58
COPY
Copy Data
Source Destination Count
1 Output_current Max_VDF_Im 1
Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
59
COPY
Copy Data
Source Destination Count
1 0 Max_VDF_Im 1
60
NOP

SG — Stage
Drive idle stage
Idle
Stage — S0

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Idle
2

E/R

TMRDOWN — Down Timer
Brake_tmr
Timer Struct — T9
Preset — 2.000s

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Brake_tmr.Done
T9.Done

Idle
3

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
RST

VDF desired frequency output
Modbus 40413
VDF_des_freq
MHR413 ≠ 70

Idle
4

MWX — Modbus Network Write
Device — @IntSerModbusClient
Unit ID — 1
Function Code — 6 - Write Single Register
Modbus Address 4… + offset value entered below
To Modbus Offset Address — 2331
Constant — 70
On Success, Set bit — C108
On Error, Set bit — C208

Select the direction of the motor.
Off => Forward direction (Close roll-off)
On => Reverse direction (Open roll-off)

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4 ≠ 0

Idle
5

MWX — Modbus Network Write
Device — @IntSerModbusClient
Unit ID — 1
Function Code — 6 - Write Single Register
Modbus Address 4… + offset value entered below
To Modbus Offset Address — 2333
Constant — 0
On Success, Set bit — C109
On Error, Set bit — C209

To move the roll off, the system has to be in:
Remote mode (local enable off)
E-stop not triggered (Estop_status off)
Motor direction commanded has to agree with GS3 direction (Motor_dir == Status_2:4)

Idle 6

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4 = 0

JMP — Transition From This Stage
Drive subprogram (Deprecated)
R_brakes
Transition To S1

Local enable is normally open, as system will jump to Local enabled stage if Local_enable is on (Local mode)

Idle 7

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

JMP — Transition From This Stage
Drive subprogram (Deprecated)
R_brakes
Transition To S1

SG — Stage
Drive subprogram (Deprecated)
R_brakes
Stage S1

R_brakes 9

$On
ST1

E/R

TMRDOWN — Down Timer
Brake_tmr
Timer Struct T9
Preset 2.000s

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
SET

R_brakes 10

Brake_tmr.Done
T9.Done

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

JMP — Transition From This Stage
Drive subprogram (Deprecated)
Motor_start
Transition To S2

R_brakes 11

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

JMP — Transition From This Stage
Drive idle stage
Idle
Transition To S0

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

SG — Stage
Drive subprogram
(Deprecated)
Motor_start
Stage — S2

Motor_start
13

$On
ST1

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

E/R

TMRDOWN — Down Timer
Brake_tmr
Timer Struct T9
Preset 2.000s

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
SET

A

Motor_start
14

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

VDF desired frequency output
Modbus 40413
VDF_des_freq
MHR413 = 70

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

Brake_tmr.Done
T9.Done

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

A

MWX — Modbus Network Write

Device @IntSerModbusClient
Unit ID 1
Function Code 6 - Write Single Register
Modbus Address 4… + offset value entered below
To Modbus Offset Address 2332
Constant 1
On Success, JMP to stage Movement
On Error, Set bit C211
Exception Response Drive_MB_except

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

Motor_start
15

MWX — Modbus Network Write

Device	@IntSerModbusClient
Unit ID	1
Function Code	6 - Write Single Register
Modbus Address 4… + offset value entered below	
To Modbus Offset Address	2332
Constant	0
On Success, JMP to stage	Drive_disable
On Error, Set bit	C211
Exception Response	Drive_MB_except

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

SG — Stage
Drive subprogram (Deprecated) Movement
Stage S3

Movement
17

$On
ST1

TMR — Timer
Dome_tout
Timer Struct T0
Preset (ms) Dome_move_tout
E/R

COPY — Copy Data

#	Source	Destination	Count
1	Dome_tout.Acc	Curr_tout_tmr	1

Set the parameters to stop the drive:
- In case of current above 10 A (100)
- In case of user command (MC 100)
- Dome timeout (set to 2 min 25 sec)
Disabled a lower value for overcurrent & timeout of 5 sec.

If heartbeat is lost, wait to close, and jump to error state

If local mode activated, stop dome and jump to error state.

VDF output current
Modbus 40415
Output_current
MHR415 ≥ 120

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Dome_tout.Done
T0.Done

Movement
18

MWX — Modbus Network Write

Device	@IntSerModbusClient
Unit ID	1
Function Code	6 - Write Single Register
Modbus Address 4… + offset value entered below	
To Modbus Offset Address	2332
Constant	0
On Success, JMP to stage	Idle
On Error, Set bit	C212
Exception Response	Drive_MB_except

GS3 Status 1
Modbus 40411
Status_1
MHR411 0

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

Dome_tout.Done
T0.Done

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Dome_tout.Done
T0.Done

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
SET

MWX — Modbus Network Write

Device	@IntSerModbusClient
Unit ID	1
Function Code	6 - Write Single Register
Modbus Address 4… + offset value entered below	
To Modbus Offset Address	2332
Constant	0
On Success, JMP to stage	Movement
On Error, Set bit	C213
Exception Response	Drive_MB_except

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

Roll-off error status
Modbus 00112
Rolloff_error
MC112
SET

Drive error LED output
Local S0:oPT12
Drive_error_led
Y12
SET

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
SET

Movement
19

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

MWX — Modbus Network Write

Device	@IntSerModbusClient
Unit ID	1
Function Code	6 - Write Single Register
Modbus Address 4… + offset value entered below	
To Modbus Offset Address	2332
Constant	0
On Success, JMP to stage	Drive_disable
On Error, Set bit	C214
Exception Response	Drive_MB_except

SG ——— Stage
Drive is disabled due to local mode or heartbeat
Drive_disable
Stage S4

S4 21

$On
ST1

TMRDOWN ——— Down Timer
Brake_tmr
Timer Struct T9
Preset 2.000s
E/R

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
SET

S4 22

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Brake_tmr.Done
T9.Done

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
RST

S4 23

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Roll-off error modbus reset
Modbus 00113
Drive_err_rst_mo
MC113

Physical switch disables hardware safety features
Local S1:iPT29
Eng_hw_mode_phy
X45

JMP ——— Transition From This Stage
Drive idle stage
Idle
Transition To S0

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

Roll-off error status
Modbus 00112
Rolloff_error
MC112
RST

Drive error LED output
Local S0:oPT12
Drive_error_led
Y12
RST

Roll-off error modbus reset
Modbus 00113
Drive_err_rst_mo
MC113
RST

S4 24

NOP

SG — Stage
HB_idle
Stage S0

HB_idle 2

$On
ST1

E/R

TMR — Timer
Heartbeat window timer
HB_timer
Timer Struct T3
Preset 1m 00.000s

HB_idle 3

Heartbeat input
Modbus 00600
HB_input
MC600

Heartbeat input
Modbus 00600
HB_input
MC600
RST

Heartbeat acknowledge
Modbus 00601
HB_ACK
MC601
SET

Heartbeat error status
Modbus 00602
HB_err_out
MC602
RST

SETNUMR — Set Numeric Range
Heartbeat missing package count
HB_error_count
Start D10
End HB_error_count
Value 0

JMP — Transition From This Stage
HB_ok_wait
Transition To S1

HB_idle 4

Heartbeat window timer
HB_timer.Done
T3.Done

Heartbeat input
Modbus 00600
HB_input
MC600

RSTT — Reset Timer
Heartbeat window timer
HB_timer
Timer Struct T3

INC — Increment
Heartbeat missing package count
HB_error_count
Element D10

HB_idle
5

Heartbeat missing package count
HB_error_count
D10 ≥ 3

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902

JMP — Transition From This Stage
HB_error
Transition To S3

SETNUMR — Set Numeric Range
Heartbeat missing package count
HB_error_count
Start D10
End HB_error_count
Value 0

SG — Stage
HB_ok_wait
Stage S1

S1
7

$On
ST1

TMR — Timer
Heartbeat acknowledge timer
HB_ack_tmr
Timer Struct T4
Preset 3.000s
E/R

S1
8

Heartbeat acknowledge timer
HB_ack_tmr.DN
T4.DN

Heartbeat acknowledge
Modbus 00601
HB_ACK
MC601
RST

JMP — Transition From This Stage
HB_idle
Transition To S0

SG — Stage
HB_error
Stage S3

HB_error
10

Drive idle stage
Idle
Drive.S0

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

HB_error
11

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

Roll-off movement direction bit
Modbus 00102
Motor_dir
MC102

Drive idle stage
Idle
Drive.S0

Roll-off movement direction bit
Modbus 00102
Motor_dir
MC102
RST

HB_error
12

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

GS3 drive directiontransitioning state
Modbus 40412
Status_2:3
MHR412:3

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4

Drive idle stage
Idle
Drive.S0

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
SET

JMP — Transition From This Stage
HB_wait_error
Transition To S4

SG — Stage
HB_wait_error
Stage S4

S4
14

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Heartbeat error status
Modbus 00602
HB_err_out
MC602
SET

RSTT — Reset Timer
Heartbeat error elapsed time
HB_err_elap_tmr
Timer Struct T5

S4
15

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Heartbeat error 30 minutes email timer
HB_err_30_min.Zero
T6.Zero

Disables software safety features
Modbus 00903
Eng_sw_mode
MC903

EMAIL — Send EMail
SMTP Device @LCO_smtp
To "lvm-critical@sdss.org"
Subject "Critical:PLC connection lost"
Space separator inserted
Message Print Script "PLC has lost communication with the server for " HB_err_seconds " seconds"
On Success, Set bit C1
On Error, Set bit C2

Heartbeat error 30 minutes email timer
HB_err_30_min.Done
T6.Done

E/R

TMR — Timer
Heartbeat error 30 minutes email timer
HB_err_30_min
Timer Struct T6
Preset 5m 00.000s

$On
ST1

EN

TMRAG — Global Accumulating Timer
Heartbeat error elapsed time
HB_err_elap_tmr
Timer Struct T5
Preset 0.000s

MATH — Calculate Expression
Heartbeat error in seconds
HB_err_seconds
Result D3
Expression (HB_err_elap_tmr.Acc / 1000) + 180

S4
16

Heartbeat error 30 minutes
email timer
HB_err_30_min.Done
T6.Done

RSTT — Reset Timer
Heartbeat error 30 minutes
email timer
HB_err_30_min
Timer Struct T6

S4
17

Heartbeat input
Modbus 00600
HB_input
MC600

Heartbeat acknowledge
Modbus 00601
HB_ACK
MC601
SET

Heartbeat input
Modbus 00600
HB_input
MC600
RST

Heartbeat error status
Modbus 00602
HB_err_out
MC602
RST

RSTT — Reset Timer
Heartbeat error elapsed
time
HB_err_elap_tmr
Timer Struct T5

JMP — Transition From This Stage
HB_ok_wait
Transition To S1

Disables software safety
features
Modbus 00903
Eng_sw_mode
MC903

EMAIL — Send EMail
SMTP Device @LCO_smtp
To "lvm-critical@sdss.org"
Subject "Critical: PLC conection restored"
Space separator inserted
Message Print Script "PLC to server communication restored after " HB_err_seconds " seconds"
On Success, JMP to stage HB_ok_wait
On Error, Set bit C2

S4
18

NOP

The rain sensor was connected using a negated logic (off = 1 & on = 0). Therefore, there are two cases were the input will be activated

1. There is rain.
2. There is an issue with the system.

The output logic is negated, to show a logic 1 if there is rain.

SG ——— Stage
Rain sensor program
Rain_idle
Stage S0

Rain sensor input
Local S1:iPT31
rain_sen_in
X47

Rain_idle
2

JMP ——— Transition From This Stage
Rain sensor program
Rain_timer
Transition To S1

Rain sensor program output
Modbus 00700
Rain_mod
MC700
SET

Modbus 40700
Rain_el_time
MHR700 = 0

Rain_idle
3

COPY ——— Copy Data

#	Source	Destination	Count
1	0	Rain_el_time	1
2	0	No_rain_cdown	1

Countdown from 15 min with no rain
Modbus 40701
No_rain_cdown
MHR701 = 0

Rain bit will be on, for 15 min after rain sensor is cleared.

Once time has past, it goes back to idle

SG ——— Stage
Rain sensor program
Rain_timer
Stage S1

Rain sensor input
Local S1:iPT31
rain_sen_in
X47

Rain_timer
5

TMRDOWN ——— Down Timer
Rain remaining time before reopening.
Rain_time
Timer Struct T7
Preset 15m 00.000s
E/R

Rain_timer 6

$On
ST1

TMR — Timer
Rain_elapsd_time
Timer Struct T8
Preset 1h 00m 00.000s
E/R

Rain_timer 7

Rain remaining time before reopening.

Rain_time.Done
T7.Done

Not used
rain_time_done
C13
SET

Rain_timer 8

Rain sensor input
Local S1:iPT31
rain_sen_in
X47

Rain remaining time before reopening.

Rain_time.Done
T7.Done

JMP — Transition From This Stage

Rain sensor program

Rain_idle
Transition To S0

Rain sensor program output
Modbus 00700
Rain_mod
MC700
RST

Rain_timer 9

NOP

SG — Stage
Drive_idle
Stage — S0

Select the direction of the motor.
Off => Forward direction (Close roll-off)
On => Reverse direction (Open roll-off)

Drive_idle
2

Rain sensor program output
Modbus 00700
Rain_mod
MC700

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Roll-off movement direction bit
Modbus 00102
Motor_dir
MC102

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4

Roll-off movement direction bit
Modbus 00102
Motor_dir
MC102

MWX — Modbus Network Write

Device	@IntSerModbusClient
Unit ID	1
Function Code	6 - Write Single Register
	Modbus Address 4… + offset value entered below
To Modbus Offset Address	2333
Constant	1
On Success, Set bit	C109
On Error, Set bit	C209

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902

Roll-off movement direction bit
Modbus 00102
Motor_dir
MC102

MWX — Modbus Network Write

Device	@IntSerModbusClient
Unit ID	1
Function Code	6 - Write Single Register
	Modbus Address 4… + offset value entered below
To Modbus Offset Address	2333
Constant	0
On Success, Set bit	C109
On Error, Set bit	C209

If it starts raining, system will automatically set drive direction to close.

Drive_idle
3

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Dome status closed
Modbus 00109
Dome_closed
MC109

GS3 1 second idle delay
Idle_1_sec_delay.Done
T13.Done

MWX — Modbus Network Write

Device	@IntSerModbusClient
Unit ID	1
Function Code	6 - Write Single Register
	Modbus Address 4… + offset value entered below
To Modbus Offset Address	2333
Constant	0
On Success, Set bit	C109
On Error, Set bit	C209

Rain sensor program output
Modbus 00700
Rain_mod
MC700

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
SET

Roll-off movement direction bit
Modbus 00102
Motor_dir
MC102
RST

GS3 1 second idle delay
Idle_1_sec_delay.Done
T13.Done

E/R

TMR — Timer
GS3 1 second idle delay
Idle_1_sec_delay
Timer Struct T13
Preset 1.000s

Jump to remove brakes. As brakes aren't connected, it will jump to start movement

A

Drive_idle
4

Roll-off lockout status
Modbus 00111
Rolloff_lout
MC111

Rain sensor program output
Modbus 00700
Rain_mod
MC700

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

Roll-off movement direction bit
Modbus 00102
Motor_dir
MC102 = MHR412:4

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4 = 0

Rain sensor program output
Modbus 00700
Rain_mod
MC700

Heartbeat error status
Modbus 00602
HB_err_out
MC602

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

Dome status closed
Modbus 00109
Dome_closed
MC109

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

A

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

JMP — Transition From This Stage
Rem_brakes
Transition To S1

$Off
ST2

JMP — Transition From This Stage
Start_movement
Transition To S2

Drive_idle
5

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Dome status closed
Modbus 00109
Dome_closed
MC109

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902

JMP — Transition From This Stage
Lockout
Transition To S10

Rain sensor program output
Modbus 00700
Rain_mod
MC700

Roll-off lockout status
Modbus 00111
Rolloff_lout
MC111
SET

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

SG — Stage
Rem_brakes
Stage S1

S1
7

$On
ST1

TMRDOWN — Down Timer
Brake_tmr
Timer Struct T9
Preset 2.000s
E/R

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
SET

S1
8

Brake_tmr.Done
T9.Done

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

JMP — Transition From This Stage
Start_movement
Transition To S2

S1
9

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

JMP — Transition From This Stage
Stop_movement
Transition To S7

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

SG — Stage
Start_movement
Stage S2

S2 11
$On
ST1

TMR — Timer
GS3 100 ms start movement delay
_100ms_delay
Timer Struct T14
Preset 0.100s
E/R

S2 12
GS3 drive speed
Drive_speed_a
V100

VDF desired frequency output
Modbus 40413
VDF_des_freq
MHR413

GS3 100 ms start movement delay
_100ms_delay.Done
T14.Done

MWX — Modbus Network Write
Device @IntSerModbusClient
Unit ID 1
Function Code 6 - Write Single Register
Modbus Address 4… + offset value entered below
To Modbus Offset Address 2331
From Do-more Memory Address Drive_speed_a
On Success, Set bit C108
On Error, Set bit C208

S2 13
Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

GS3 drive speed
Drive_speed_a
V100

VDF desired frequency output
Modbus 40413
VDF_des_freq
MHR413

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

MWX — Modbus Network Write
Device @IntSerModbusClient
Unit ID 1
Function Code 6 - Write Single Register
Modbus Address 4… + offset value entered below
To Modbus Offset Address 2332
Constant 1
On Success, Set bit C111
On Error, Set bit C211
Exception Response Drive_MB_except

A

S2 14
GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4

GS3 drive directiontransitioning state
Modbus 40412
Status_2:3
MHR412:3

Dome status open
Modbus 00110
Dome_open
MC110

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4

GS3 drive directiontransitioning state
Modbus 40412
Status_2:3
MHR412:3

Dome status closed
Modbus 00109
Dome_closed
MC109

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

A

JMP —— Transition From This Stage
Open_roof
Transition To S3

JMP —— Transition From This Stage
Close_roof
Transition To S5

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
(RST)

S2
15

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

GS3 drive directiontransitioning state
Modbus 40412
Status_2:3
MHR412:3

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4

Dome status open
Modbus 00110
Dome_open
MC110

GS3 drive directiontransitioning state
Modbus 40412
Status_2:3
MHR412:3

GS3 drive direction
Modbus 40412
Status_2:4
MHR412:4

Dome status closed
Modbus 00109
Dome_closed
MC109

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

JMP —— Transition From This Stage
Stop_movement
Transition To S7

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

SG — Stage
Open_roof
Stage — S3

Open_roof
17
$On
ST1

TMRDOWN — Down Timer
Dome_tout
Timer Struct — T0
Preset (ms) — Tout_open

E/R

COPY — Copy Data

#	Source	Destination	Count
1	Dome_tout.Acc	Curr_tout_tmr	1
2	Dome_tout.Acc	Opn_tout_tmr	1

South-east limit switch
input
Local S1:iPT22
LS_SE_in
X38

Open_roof
18

MWX — Modbus Network Write

Device — @IntSerModbusClient
Unit ID — 1
Function Code — 6 - Write Single Register
Modbus Address 4… + offset value entered below
To Modbus Offset Address — 2331
From Do-more Memory Address — Drive_speed_b
On Success, JMP to stage — Open_aproach
On Error, Set bit — C208

South-west limit switch
input
Local S1:iPT18
LS_SW_in
X34

Open count mid limit
Open_count_mid
$Dome_encoder.iReg1 D100 ≥

Dome_tout.Done
T0.Done

Open_roof
19

JMP — Transition From This Stage
Stop_movement
Transition To — S7

GS3 Status 1
Modbus 40411
Status_1
MHR411 0 ≠

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

Rain sensor program output
Modbus 00700
Rain_mod
MC700

SG — Stage
Open_aproach
Stage — S4

S4
21
$On
ST1

E/R
TMRDOWN — Down Timer
Dome_tout
Timer Struct — T0
Preset (ms) — Tout_open_aprch

E/R
TMRDOWN — Down Timer
GS3 state countdown
T_countdown
Timer Struct — T11
Preset (ms) — Topen_apr

COPY — Copy Data

#	Source	Destination	Count
1	Dome_tout.Acc	Curr_tout_tmr	1
2	T_countdown.Acc	Opn_apr_tmr	1
3	Dome_tout.Acc	Opn_apr_tout_tmr	1

Rain sensor program output
Modbus 00700
Rain_mod
MC700

S4
22

JMP — Transition From This Stage
Stop_movement
Transition To — S7

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Dome_tout.Done
T0.Done

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

GS3 Status 1
Modbus 40411
Status_1
MHR411 0

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

VDF output current
Modbus 40415
Output_current
MHR415 ≥ D103

Motor current limit for end of movement
Im_limit

Open coun final limit
Open_count_final
$Dome_encoder.iReg1 ≥ D101

VDF output current
Modbus 40415
Output_current
MHR415 ≥ D103

Motor current limit for end of movement
Im_limit

GS3 state countdown
T_countdown.Done
T11.Done

Open coun final limit
Open_count_final
$Dome_encoder.iReg1 ≥ D101

GS3 state countdown
T_countdown.Done
T11.Done

SG — Stage
Close_roof
Stage — S5

Close_roof
24

$On
ST1

E/R

TMRDOWN — Down Timer
GS3 state countdown
T_countdown
Timer Struct — T11
Preset (ms) — Tclose

COPY — Copy Data

#	Source	Destination	Count
1	T_countdown.Acc	Cls_tmr	1

GS3 Status 1
Modbus 40411
Status_1
Close_roof
25
MHR411 0

JMP — Transition From This Stage
Stop_movement
Transition To S7

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

GS3 state countdown
T_countdown.Done
Close_roof
26
T11.Done

MWX — Modbus Network Write

Device	@IntSerModbusClient
Unit ID	1
Function Code	6 - Write Single Register
	Modbus Address 4… + offset value entered below
To Modbus Offset Address	2331
From Do-more Memory Address	Drive_speed_b
On Success, JMP to stage	Close_roof_apr
On Error, Set bit	C208

Close count mid limit
Close_count_mid
$Dome_encoder.iReg1 D102
<=

SG — Stage
Close_roof_apr
Stage S6

$On
S6
28
ST1

E/R

TMRDOWN — Down Timer
Dome_tout
Timer Struct T0
Preset (ms) Tout_close_apr

COPY — Copy Data

#	Source	Destination	Count
1	Dome_tout.Acc	Curr_tout_tmr	1
2	Dome_tout.Acc	Cls_apr_tout_tmr	1

S6
29

Dome_tout.Done
T0.Done

JMP —— Transition From This Stage
Stop_movement
Transition To S7

GS3 Status 1
Modbus 40411
Status_1
MHR411 0

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

VDF output current
Modbus 40415
Output_current
MHR415 D103 ≥

Motor current limit for end of movement
Im_limit

$Dome_encoder.iReg1 0 ≤

VDF output current
Modbus 40415
Output_current
MHR415 D103 ≥

Motor current limit for end of movement
Im_limit

North-eastt limit switch input
Local S1:iPT20
LS_NE_in
X36

North-west limit switch input
Local S1:iPT16
LS_NW_in
X32

North-eastt limit switch input
Local S1:iPT20
LS_NE_in
X36

$Dome_encoder.iReg1 0 ≤

North-west limit switch input
Local S1:iPT16
LS_NW_in
X32

SG —— Stage
Stop_movement
Stage S7

S7
31

$On
ST1

MWX — Modbus Network Write

Device	@IntSerModbusClient
Unit ID	1
Function Code	6 - Write Single Register
	Modbus Address 4… + offset value entered below
To Modbus Offset Address	2332
Constant	0
On Success, JMP to stage	Stop_move_select
On Error, Set bit	C211
Exception Response	Drive_MB_except

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
SET

SG — Stage
Stop_move_select
Stage S11

S11
33

GS3 drive movement status
Modbus 40412
Status_2:1
MHR412:1

GS3 drive movement transitioning state
Modbus 40412
Status_2:0
MHR412:0

$On
ST1

JMP — Transition From This Stage
Set_brakes
Transition To S8

Current movment timeout timer (ms)
Curr_tout_tmr
R0 0
=

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

$Off
ST2

JMP — Transition From This Stage
Error
Transition To S9

GS3 Status 1
Modbus 40411
Status_1
MHR411 0
≠

Roll-off error status
Modbus 00112
Rolloff_error
MC112
SET

Current movment timeout timer (ms)
Curr_tout_tmr
R0 0
≠

GS3 Status 1
Modbus 40411
Status_1
MHR411 0
=

$Off
ST2

JMP — Transition From This Stage
Drive_idle
Transition To S0

S11
34

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

JMP —— Transition From This Stage
Lockout
Transition To S10

Roll-off lockout status
Modbus 00111
Rolloff_lout
MC111
SET

SG —— Stage
Set_brakes
Stage S8

Set_brakes
36

$On
ST1

E/R

TMRDOWN —— Down Timer
Brake_tmr
Timer Struct T9
Preset 2.000s

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Brake_tmr.Done
T9.Done

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
SET

Set_brakes
37

Brake_tmr.Done
T9.Done

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
RST

Set_brakes
38

Brake_tmr.Done
T9.Done

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Current movment timeout timer (ms)
Curr_tout_tmr
R0 0

GS3 Status 1
Modbus 40411
Status_1
MHR411 0

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

JMP —— Transition From This Stage
Error
Transition To S9

Roll-off error status
Modbus 00112
Rolloff_error
MC112
SET

Drive error LED output
Local S0:oPT12
Drive_error_led
Y12
SET

Current movment timeout timer (ms)
Curr_tout_tmr
R0 0 ≠

GS3 Status 1
Modbus 40411
Status_1
MHR411 0 =

JMP —— Transition From This Stage
Drive_idle
Transition To S0

SG —— Stage
Error
Stage S9

Error 40

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

Error 41

Roll-off error modbus reset
Modbus 00113
Drive_err_rst_mo
MC113

GS3 Status 1
Modbus 40411
Status_1
MHR411 0 =

Drive error physical reset
Local S1:iPT30
Drive_err_rst
X46

JMP —— Transition From This Stage
Drive_idle
Transition To S0

Roll-off error status
Modbus 00112
Rolloff_error
MC112
RST

Roll-off error modbus reset
Modbus 00113
Drive_err_rst_mo
MC113
RST

Drive error LED output
Local S0:oPT12
Drive_error_led
Y12
RST

SG —— Stage
Lockout
Stage S10

Lockout 43

$On
ST1

TMRDOWN —— Down Timer
Brake_tmr
Timer Struct T9
Preset 2.000s
E/R

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9

Brake_tmr.DN
T9.DN

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
SET

Lockout 44

Roll-off roof brake release
Local S0:oPT9
Brake_tmr.DN
T9.DN
Brake_start
Y9

Roll-off roof brake release
Local S0:oPT9
Brake_start
Y9
RST

Lockout 45

Rain sensor program output
Modbus 00700
Rain_mod
MC700

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Telescope platform on local mode
Modbus 00003
Local_enable
MC3

Shows if E-stop is active
Local S1:iPT24
Estop_status
X40

JMP —— Transition From This Stage

Drive_idle
Transition To S0

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902

Roll-off lockout status
Modbus 00111
Rolloff_lout
MC111
RST

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

Lockout 46

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100

Roll-off movement enable bit
Modbus 00100
Dome_enable
MC100
RST

Lockout 47

NOP

SG ——— Stage
HB_idle_new
Stage S0

S0
2
$On
ST1

TMR ——— Timer
Heartbeat window timer
HB_timer
Timer Struct T3
Preset 1m 00.000s
E/R

S0
3
Heartbeat input
Modbus 00600
HB_input
MC600

Heartbeat input
Modbus 00600
HB_input
MC600
RST

Heartbeat acknowledge
Modbus 00601
HB_ACK
MC601
SET

SETNUMR —— Set Numeric Range
Heartbeat missing package count
HB_error_count
Start D10
End HB_error_count
Value 0

JMP —— Transition From This Stage
HB_ok_wait_new
Transition To S1

S0
4
Heartbeat window timer
HB_timer.Done
T3.Done

Heartbeat input
Modbus 00600
HB_input
MC600

RSTT ——— Reset Timer
Heartbeat window timer
HB_timer
Timer Struct T3

INC ——— Increment
Heartbeat missing package count
HB_error_count
Element D10

S0
5
Heartbeat missing package count
HB_error_count
D10 ≥ 3

Disables hardware safety features
Modbus 00902
Eng_hw_mode
MC902

JMP —— Transition From This Stage
HB_error_wait
Transition To S4

SETNUMR — Set Numeric Range
Heartbeat missing package count
HB_error_count
Start D10
End HB_error_count
Value 0

Heartbeat error status
Modbus 00602
HB_err_out
MC602
SET

SG — Stage
HB_ok_wait_new
Stage S1

S1
7

$On
ST1

TMR — Timer
Heartbeat acknowledge timer
HB_ack_tmr
Timer Struct T4
Preset 3.000s

E/R

Heartbeat acknowledge timer
HB_ack_tmr.DN
T4.DN

S1
8

Heartbeat acknowledge
Modbus 00601
HB_ACK
MC601
RST

JMP — Transition From This Stage
HB_idle_new
Transition To S0

SG — Stage
HB_error_wait
Stage S4

S4
10

Heartbeat error status
Modbus 00602
HB_err_out
MC602

Heartbeat error 30 minutes email timer
HB_err_30_min.Zero
T6.Zero

Disables software safety features
Modbus 00903
Eng_sw_mode
MC903

EMAIL — Send EMail
SMTP Device @LCO_smtp
To "lvm-critical@sdss.org"
Subject "Critical:PLC connection lost"
Space separator inserted
Message Print Script "PLC has lost communication with the server for " HB_err_seconds " seconds"
On Success, Set bit C1
On Error, Set bit C2

Heartbeat error 30 minutes email timer
HB_err_30_min.Done
T6.Done

Internet connection given by LVMECP
Modbus 00603
Internet_disable
MC603

E/R

TMR — Timer
Heartbeat error 30 minutes email timer
HB_err_30_min
Timer Struct T6
Preset 30m 00.000s

$On
ST1

E/R

TMR — Timer
Heartbeat error elapsed time
HB_err_elap_tmr
Timer Struct T5
Preset 0.000s

MATH — Calculate Expression
Heartbeat error in seconds
HB_err_seconds
Result D3
Expression (HB_err_elap_tmr.Acc / 1000) + 180

S4
11

Heartbeat error 30 minutes email timer
HB_err_30_min.Done
T6.Done

RSTT — Reset Timer
Heartbeat error 30 minutes email timer
HB_err_30_min
Timer Struct T6

S4
12

Heartbeat input
Modbus 00600
HB_input
MC600

$On
ST1

Heartbeat acknowledge
Modbus 00601
HB_ACK
MC601
SET

Heartbeat input
Modbus 00600
HB_input
MC600
RST

Heartbeat error status
Modbus 00602
HB_err_out
MC602
RST

RSTT — Reset Timer
Heartbeat error elapsed time
HB_err_elap_tmr
Timer Struct T5

Disables software safety features
Modbus 00903
Eng_sw_mode
MC903

EMAIL — Send EMail

SMTP Device @LCO_smtp
To "lvm-critical@sdss.org"
Subject "Critical: PLC conection restored"
Space separator inserted
Message Print Script "PLC to server communication restored after " HB_err_seconds " seconds"
On Success, JMP to stage HB_ok_wait_new
On Error, Set bit C2

Disables software safety features
Modbus 00903
Eng_sw_mode
MC903

JMP — Transition From This Stage

HB_ok_wait_new
Transition To S1

S4
13

NOP

1
$FirstScan
ST0
NETTIME
SNTP Client
Device @IntEthernet
SNTP Server IP Address 200.27.106.116
UDP Port Number 123
Network Timeout (ms) 1000
On Success, Set bit NTP_read_ok
On Error, Set bit NTP_read_err
$Now.Hour
SDT0.Hour = 12
$Now.Minute
SDT0.Minute = 00
$Now.Second
SDT0.Second = 00
2
NOP