NWC NETWORK Controller

NWC – Modbus Slave Interface

Reference Manual

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Abstract

This user manual documents the Slave Modbus Data Interface in the Network Controller (NWC). It describes the supported Modbus function codes and the NWC's register map with all necessary details to correctly interpret the reported data.

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Chapter 2 Introduction

Document Overview

This document is the reference manual for the NWC Modbus Slave Interface. This manual describes the defined Modbus readable and writable variables on the NWC. The Modbus Slave Interface allows the reporting of the real time data related to the Tunnel Lighting Addressable Control System (TLACS) to a third party system. For more information about the TLACS, NWC and LPC, please refer to the other documentation indicated in the references below.

Glossary

Bus	Electrical link for power line communication. A bus will normally be created for each phase of an electrical distribution panel within a zone.
FAA	Failure Alarm Active.
LPC	Local Product Controller. Nyx Hemera Technologies' individual luminaire controller.
LSR	Lighting Stage Request. Requested luminance, a higher value indicates higher luminance.
NWC	Network Controller. Nyx Hemera Technologies' central controller for the TLACS.
TLACS	Tunnel Lighting Addressable Control System. Nyx Hemera Technologies tunnel lighting control system.
Zone	Area where a series of LPCs are located to control luminaires or contactors.

TLACS Overview

The Tunnel Lighting Addressable Control System (TLACS) is designed, supplied, installed, tested and commissioned for the purpose of automatic control and monitoring of multiple lights. It is designed specifically for tunnel lighting control. TLACS allows remote monitoring and control from designated engineering stations. It controls the lamps ON/OFF and/or DIM up or down automatically based on a requested luminance levels, a pre-determined schedule or manually. More details can be found in the other TLACS, NWC and LPC manuals.

NWC Overview

The NWC is the TLACS' main controller designed to monitor and control up to 1022 LPCs. It sends individual or global commands to every LPC under its control. It also holds status and configuration information related to the LPCs. More details can be found in the other TLACS, NWC and LPC manuals.

LPC Overview

The LPC is the TLACS' local controller designed to control and monitor individual every lamp/luminaire connected to its relay. According to its internal parameters and the data received from the NWC, toggles the lamp ON or OFF. Depending on the type of LPC and luminaire, dimming can also be performed. The LPC monitors the current that flows through the relay in order to detect lamp failure. More details are ca be found in the other TLACS, NWC and LPC manuals.

References

- TLACS-USM-001: TLACS user manual
- NWC-USM-002: NWC user manual
- LPC-USM-001: LPC user manual

Chapter 3 Modbus Function Codes

The following table lists the Modbus public function codes supported by the NWC. The function code's descriptions can be found in the Modbus Application Protocol version 1.1b3 document (ref: www.modbus.org/specs.php).

Even though the NWC supports the most common requests from the Modbus master, the data is mainly Read Only, so only the Modbus function codes "Read Coils" or "Read Discrete Inputs" and "Read Holding Registers" or "Read Input Registers" requests are required.

Function Name	ID
Read Coils	01
Read Discrete Inputs	02
Read Holding Registers	03
Read Input Registers	04
Write Single Coil	05
Write Single Register	06
Write Multiple Coils	15
Write Multiple Registers	16

Table 1 Modbus Supported Public Function Codes

Notes:

- 32 bits registers are reported with low register first
- The data map is 0 based.

Chapter 4 Variables details

This section describes the different variables and how their field should be interpreted. The data map is available in Chapter 4

Dry Contact Inputs

Bit Value	Status Details
0	Input level state is **LOW**
1	Input level state is **HIGH**

Table 2 NWC Dry Contact Input Status Bit Definition

Dry Contact Outputs

Bit Value	Status Details
0	Output level state is **LOW**
1	Output level state is **HIGH**

Table 3 NWC Dry Contact Output Status Bit Definition

Bus FAA

Bit Value	Status Details
0	The bus is **Online (failure inactive)**
1	The bus is **Offline (failure active)**

Table 4 Bus FAA Status Bit Definition

Camera FAA

Bit Value	Status Details
0	Photometer is **OK**
1	Photometer is in **Alarm**

Table 5 Camera FAA Status Bit Definition

LPC FAA

Bit Value	Status Details
0	NWC – LPC communication **OK**
1	NWC – LPC communication **Failure**

Table 6 LPC FAA Status Bit Definition

LPC information block

The LPC information block holds all the available data of one LPC. Each LPC has its own data block for a potential total of 1022 data blocks. Each block has the size of 18 registers.

Value	Value Details					
Unsigned 16 bits	Alarm					
	LPC FAA	Spare	LPC Power Failure	Spare	Communication failure detected by LPC	Alarm Code
	(1 bit)	(7 bits)	(1 bit)	(3 bits)	(1 bit)	(3 bits)
Unsigned 16 bits	Relay 1 Status:					
	0: Relay open, manual control					
	1: Relay closed, manual control					
	2: Relay open, automatic control					
	3: Relay closed, automatic control					
Unsigned 16 bits	Internal Diagnostic information, for use by Nyx Hemera Technologies only					
Unsigned 16 bits	Configured LSR stage to turn light ON					
Unsigned 16 bits	Burn hour percentage: value = raw *0.1 (0 = 0% and 1000 = 100%)					
Unsigned 16 bits	Voltage: value = raw * 0.1 VRMS					
Unsigned 16 bits	Frequency: value = raw * 0.01 Hz					
Unsigned 16 bits	Current: value = raw * 0.001 (0=0A and 22000=22A)					
	Example: Current = 1175 * 0.001 = 1.175 A					
Unsigned 16 bits	Power Factor: value = raw * 0.01 (0=0 and 100 = 1)					
	Example: value = 98 * 0.01= 0.98 PF					
Signed 16 bits	Processor Temperature: value * 0.1					
	Example: temperature = 202 + * 0.1 = 20.2					
Unsigned 32 bits	Active power relay #1: value = raw * 0.001 Watt					
	Example: Power = 350500 * 0.001 = 350.5 Watt					
Unsigned 32 bits	Energy Relay 1: value = raw * 1 Wh. This is not available at the moment.					
SPARE 64 bits	Future use 4 registers					

Table 7 LPC Information Block

LPC FAA bit field

Bit Value	Status Details
0	NWC – LPC communication **OK**
1	NWC – LPC communication **Failure**

Table 8 LPC FAA bit field

LPC Power Failure bit field. Set on LPC restart, reset on communication with NWC

Bit Value	Status Details
0	**No**: there was no power failure since the last communication.
1	**Yes**: there was power failure since the last communication

Table 9 LPC Power Failure bit filed

Communication failure detected by LPC bit field. Set after communication timeout by LPC, reset on communication with NWC.

Bit Value	Status Details
0	**No**: the LPC did not have a communication timeout since the last communication
1	**Yes**: the LPC did have a communication timeout since the last communication

Table 10 Communication failure LPC bit field

Alarm code description

Alarm Code	Alarm
XXXXX000 (0)	Normal State
XXXXX001 (1)	Current out of threshold
XXXXX010 (2)	Relay short circuit
XXXXX100 (4)	No Current
XXXXX101 (5)	Low power factor
XXXXX110 (6)	Relay short circuit (recurrent)
XXXXX111 (7)	No Current (recurrent)
11111111 (255)	Metering error

Table 11 LPC Alarm Code Description

Bus information block

The Bus information block holds all the available data of one Bus. Each Bus has its own data block, for a potential total of 32 data blocks. Each block has the size of 6 registers.

Value	Value Details
Unsigned 16 bits	Actual LSR level
Unsigned 16 bits	Total number of LPCs in bus
Unsigned 16 bits	Total number of Failed LPCs in bus
Unsigned 16 bits	Active photometer number used in the bus (1 = virtual camera, 2 and up are the physical photometer.
SPARE 32 bits	Future use 2 registers

Table 12 Bus information block definition

LCAM/ILCAM photometer information block

The LCAM/ILCAM information block holds all the available data of one luminance photometer. Each photometer has its own data block, for a total of 31 data blocks. Each block has the size of 74 registers.

Value	Value Details	
Unsigned 16 bits	Alarm/Status	
	LCAM FAA (1bit)	Alarm code (15 bits)
Unsigned 16 bits	LSR	
Float 32 bits	Luminance	
Float 32 bits	Temperature	
Signed 16 bits	Hysteresis delay minutes -1 = ILCAM, 0 = No camera, >0 LCAM value	
Unsigned 16 bits	LSR 2 ON - LSR 32 ON (31 values)	
Unsigned 16 bits	LSR 2 OFF - LSR 32 OFF (31 values)	
SPARE 80 bits	Future use 5 registers	

Table 13 LCAM/ILCAM Information block

LCAM FAA bit field

Bit Value	Status Details
0	NWC – meter communication **OK**
1	NWC – meter communication **Failure**

Table 14 LCAM FAA Bit field

Alarm/Status code, the alarms and status are bit coded and can be combined to have multiple alarms/status active. The normal situation has Bit 0 and Bit 1 high (value 3)

Alarm/Status Code	Alarm/Status
Bit 0	Data valid (1 valid, 0 not valid)
Bit 1	Photometer in use (1 in use, 0 not used in the system)
Bit 2	ILCAM value out of threshold
Bit 3	Memory fault
Bit 4	Spare
Bit 5	CRC Fault
Bit 6	Low water level.

Table 15 LCAM Alarm/Status Code

The Hysterisis delay combines the indication of the type of photometer and the value

Delay Value	Description
-1	Used photometer is an ILCAM which does not have this delay
0	No photometer configured
Positive value	LCAM delay as configured.

Table 16 Delay definition

Chapter 5 Data map

This section describes the layout of the data as reported by the NWC to the third party. For a complete listing please refer to the Excel data map document.

Discrete inputs / coils

All Bit data can be read using the read discrete input or read coil request.

Address (Decimal)	Variable
0 to	Dry input 1
7	Dry input 8
10 to	Dry output 1
17	Dry output 8
100 to	FAA for bus 1
131	FAA for bus 32
150 to	FAA for camera 1
181	FAA for camera 32
200 to	FAA for LPC address 2, this is the first LPC within the system.
1221	FAA for LPC address 1023

Table 17 Bit inputs

Input registers / Holding registers

All Register data can be read using the read Input Registers or read Holding Register request.

Address (Decimal)	Size (number of registers)	Variable	Size / Format
0	1	Dry Contact Input 8-1	UINT 16
10	1	Dry Contact Output 8-1	UINT 16
20	2	NWC 12 Volt	Float 32
22	2	NWC 5 Volt	Float 32
24	2	NWC 3.3 Volt	Float 32
26	2	NWC Temperature	Float 32
28	1	NWC Firmware version-Major Version	UINT16
29	1	NWC Firmware version-Minor Version	UINT16
30	1	NWC Firmware version-Revision	UINT16
31	1	NWC Firmware version-Compilation number	UINT16
32	2	NWC-Latitude	Float 32
34	2	NWC-Longitude	Float 32
36	1	NWC-Time zone	INT16
50	1	Maintenance mode LSR level (1 to 32), 128 = disable maintenance	UINT16

100	2	FAA bus 32-1	UINT 32
110	2	FAA camera 32-1	UINT 32
128 to	1	FAA for LPC 15-0	UINT 16
191	1	FAA for LPC 1023-1008	UINT 16
200	6	Bus 1 Information block	Bus information block
206 to	6	Bus 2 Information block	Bus information block
386	6	Bus 32 Information block	Bus information block
1000	18	LPC 2 Information block	LPC information block
1018 to	18	LPC 3 Information block	LPC information block
19378	18	LPC 1023 Information block	LPC information block
23000	1	Number of Virtual levels Sunrise	INT16
23001	1	Sunrise Activation Offset LSR 2	INT16
23002	1	Sunrise Activation Offset LSR 3	INT16
23003	1	Sunrise Activation Offset LSR 4	INT16
23004	1	Sunrise Activation Offset LSR 5	INT16
23005	1	Sunrise Activation Offset LSR 6	INT16
23006	1	Sunrise Activation Offset LSR 7	INT16
23007	1	Sunrise Activation Offset LSR 8	INT16
23008	1	Sunrise Activation Offset LSR 9	INT16
23009	1	Sunrise Activation Offset LSR 10	INT16
23010	1	Sunrise Activation Offset LSR 11	INT16
23011	1	Sunrise Activation Offset LSR 12	INT16
23012	1	Sunrise Activation Offset LSR 13	INT16
23013	1	Sunrise Activation Offset LSR 14	INT16
23014	1	Sunrise Activation Offset LSR 15	INT16
23015	1	Sunrise Activation Offset LSR 16	INT16
23016	1	Sunrise Activation Offset LSR 17	INT16
23017	1	Sunrise Activation Offset LSR 18	INT16
23018	1	Sunrise Activation Offset LSR 19	INT16
23019	1	Sunrise Activation Offset LSR 20	INT16
23020	1	Sunrise Activation Offset LSR 21	INT16
23021	1	Sunrise Activation Offset LSR 22	INT16
23022	1	Sunrise Activation Offset LSR 23	INT16
23023	1	Sunrise Activation Offset LSR 24	INT16
23024	1	Sunrise Activation Offset LSR 25	INT16
23025	1	Sunrise Activation Offset LSR 26	INT16
23026	1	Sunrise Activation Offset LSR 27	INT16
23027	1	Sunrise Activation Offset LSR 28	INT16

23028	1	Sunrise Activation Offset LSR 29	INT16
23029	1	Sunrise Activation Offset LSR 30	INT16
23030	1	Sunrise Activation Offset LSR 31	INT16
23031	1	Sunrise Activation Offset LSR 32	INT16
23050	1	Number of Virtual levels Sunset	INT16
23051	1	Sunset Activation Offset LSR 2	INT16
23052	1	Sunset Activation Offset LSR 3	INT16
23053	1	Sunset Activation Offset LSR 4	INT16
23054	1	Sunset Activation Offset LSR 5	INT16
23055	1	Sunset Activation Offset LSR 6	INT16
23056	1	Sunset Activation Offset LSR 7	INT16
23057	1	Sunset Activation Offset LSR 8	INT16
23058	1	Sunset Activation Offset LSR 9	INT16
23059	1	Sunset Activation Offset LSR 10	INT16
23060	1	Sunset Activation Offset LSR 11	INT16
23061	1	Sunset Activation Offset LSR 12	INT16
23062	1	Sunset Activation Offset LSR 13	INT16
23063	1	Sunset Activation Offset LSR 14	INT16
23064	1	Sunset Activation Offset LSR 15	INT16
23065	1	Sunset Activation Offset LSR 16	INT16
23066	1	Sunset Activation Offset LSR 17	INT16
23067	1	Sunset Activation Offset LSR 18	INT16
23068	1	Sunset Activation Offset LSR 19	INT16
23069	1	Sunset Activation Offset LSR 20	INT16
23070	1	Sunset Activation Offset LSR 21	INT16
23071	1	Sunset Activation Offset LSR 22	INT16
23072	1	Sunset Activation Offset LSR 23	INT16
23073	1	Sunset Activation Offset LSR 24	INT16
23074	1	Sunset Activation Offset LSR 25	INT16
23075	1	Sunset Activation Offset LSR 26	INT16
23076	1	Sunset Activation Offset LSR 27	INT16
23077	1	Sunset Activation Offset LSR 28	INT16
23078	1	Sunset Activation Offset LSR 29	INT16
23079	1	Sunset Activation Offset LSR 30	INT16
23080	1	Sunset Activation Offset LSR 31	INT16
23081	1	Sunset Activation Offset LSR 32	INT16
24000	74	Camera 1 Information block	LCAM/ILCAM information block
24074 to	74	Camera 2 Information block	LCAM/ILCAM information block
26220	74	Camera 31 Information block	LCAM/ILCAM information block

Table 18 Register inputs

Writing data

The following tags can be controlled from the third party system.

Coils:

Address (Decimal)	Variable
10 to	Dry output 1
17	Dry output 8

Table 19 Bit outputs

Holding registers:

Address (Decimal)	Size (number of registers)	Variable	Size / Format
50	1	Maintenance mode LSR level (1 to 32), 128 = disable maintenance	UINT16

Table 20 Register outputs