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*Traffic Controller Assemblies
with NTCIP Requirements*

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Foreword

This NEMA Standards Publication TS 2-2003, *Traffic Controller Assemblies with NTCIP Requirements*, has been developed as a design guide for traffic signaling equipment which can be safely installed and provide operational features not covered by the NEMA TS 1-1989, *Traffic Control Systems*. Within the standard, any reference to a specific manufacturer is made strictly for the purpose of defining interchangeability where there exists no nationally recognized standard covering all the requirements. The manufacturer references do not constitute a preference.

The TS 2 Standards Publication has been established to reduce hazards to persons and property when traffic signaling equipment is properly selected and installed in conformance with the requirements herein.

The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith.

Comments and suggestions for the improvement of this document are encouraged. They should be sent to:

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Scope

This Standards Publication covers traffic signaling equipment used to facilitate and expedite the safe movement of pedestrians and vehicular traffic.

Two approaches to expansion of traffic features of NEMA TS 1, *Traffic Control Systems*, are provided:

Type 1—

- Entirely new performance oriented standard.

Type 2—

- Use of the MSA, B, and C connectors in common use with NEMA TS 1 equipment.

The Type 1 approach embraces:

- Controller Unit
 - Display-alphanumeric Display—32 Characters, 2 Lines Minimum
 - Port 1 Connector
 - High speed full duplex data channel connecting controller unit, conflict monitor (malfunction management unit), rear panel (terminals and facilities) and detectors.
 - All data exchange with rear panel.
 - Controller unit and conflict monitor exchange information on a regular basis, performing redundant checks on each other. Controller unit has access to all conflict monitor internal information, making enhanced event logging, remote intersection monitoring, and remote diagnostics feasible.
 - All detector information, including detector diagnostics.
 - EIA-485 serial communications interface with noise immunity characteristics.
 - SDLC (synchronous data link) communication protocol with a bit rate of 153, 600 bits/second, utilizing sophisticated error checking.
 - Vast reduction in number of wires in the cabinet.
 - Port 2 Connector
 - Interface to personal computer.
 - Interface to printer.
 - Port 3 Connector
 - 1200 baud, FSK serial port for on-street communications.

History

This Standards Publication is predicated upon an industry perceived need to overcome limitations of the NEMA Standards Publication TS 1, *Traffic Control Systems*, which in 1976 reflected the first industry documentation of technically adequate and safe traffic control equipment.

The NEMA TS 1 as subsequently revised and expanded and re-affirmed in 1989:

1. Defined effective actuated intersection control.
2. As a complete package defined all equipment within the cabinet and test procedures.
3. Provided equipment interchangeability between manufacturers.
4. As a minimum functional standard facilitated design innovations.

Limitations inherent in NEMA TS 1 were seen as follows:

1. Reliance on point-to-point wire connection for all functions with termination points for all wires, many of which are not utilized.
 - a. Numerous connections increase failure potential.
 - b. Not cost effective.
 - c. Hardware limited expandability.
2. Out-of-date technology.
3. Lack of uniformity in the implementation of the following functions and the resulting loss in equipment interchangeability:
 - a. Coordination.
 - b. Time base control.
 - c. Preemption.
 - d. Uniform Code flash.
 - e. Communications.
 - f. Diagnostics.
 - g. User interface.

The following industry guidelines were established to overcome the limitations in the NEMA TS 1 Standards Publication:

1. Equipment requirements based on valid engineering concepts.
2. Interchangeability, performance oriented, without precluding downward compatibility with TS 1 equipment.
3. Emphasis on use of enhanced diagnostic techniques.
4. Minimize potential for malfunctions.
5. Provide for future expandability.
6. Enhanced user interface.

Four basic proposals were considered over a four-year period. These were:

1. Standardize the functions being provided on the MSD connector.
2. Free up seldom used pins on the MSA, MSB, and MSC connectors and reassign them to needed functions.
3. Develop an entirely new, performance oriented standard.
4. Proceed with Proposal 1, then move on to Proposal 3 for a long-term solution.

During the investigations, involving debate within the industry and inputs received from traffic engineers and those responsible for the selection, installation and maintenance of traffic control equipment actions were taken on each proposal.

Industry debate of which approach to follow consumed approximately 2.5 years before approval of Proposal 3—proceed with the development of an entirely new, performance oriented standard. While the majority of the industry tended to favor this proposal, some members in opposition had concerns, many of which were valid, and each was carefully studied and evaluated, including joint consultations with delegations from the Institute of Transportation Engineers (ITE) and the International Municipal Signal Association (IMSA), as well as at NEMA sponsored open forums at Annual Meetings of ITE.

The advantages of a new performance oriented standard were identified as:

1. Communication between major equipment within the cabinet over a data channel with virtually unlimited capacity. Potential for future expandability is thereby maximized.
2. Use of a high speed data channel between the controller unit, malfunction management unit, detectors, and rear panel reduces the number of connections and facilitates diagnostic testing, thereby reducing the potential for malfunction.
3. Cost effectiveness of communications protocols.
4. Enhanced user interface.

During the development of the new NEMA Standards Publication TS 2, two approaches evolved:

1. Type 1, which utilizes a high speed data channel between all major equipment to maximize the functionality and expandability.
2. Type 2, which retains the MSA, MSB, and MSC connectors for data exchange with the rear panel, providing a degree of downward compatibility.

Document version numbers are assigned retroactively as follows:

- TS 2-1992 v01.00, *Traffic Controller Assemblies*, is retroactively referenced as v01.00.
- TS 2-1998 v02.04, *Traffic Controller Assemblies*, which includes updates described in the front matter section, "TS 2-1998 Update," is retroactively referenced as v02.04. The letter ballot was of version 98.03.
- TS 2 Amendment 1 v01, March 2001, was approved by NEMA in November 2001. The amendment revises section 8.
- TS 2 -1998 v02.05, *Traffic Controller Assemblies*, which is the 1998 version when revised in accordance with Amendment 1 v01, is retroactively referenced as v02.05.
- TS 2-2003 v02.06, *Traffic Controller Assemblies with NTCIP Requirements*, is the revised and re-balloted version, including the revisions from Amendment 1 v01 and minor revisions to sections 3, 5, and 6, as detailed on the "Update" page and as noted by change bars. TS 2-2003 v02.06 was balloted in January 2003 and approved by NEMA in May 2003.

TS 2-1998 Update

The following is a summary of the changes provided by the 1998 release of this Standards Publication:

SECTION 2:

The Standard Publication has been restructured to move all testing criteria into Section 2.

SECTION 3:

Type 129 MMU Inputs/Status frame has been updated to add 'Start-Up Flash Call' bit. This status bit enables the CU to enter the Start-Up Flash state following any Terminal & Facilities flash mode.

NTCIP Requirements has been added. Additional Controller Unit types with two Conformance Levels has been added for NTCIP requirements.

Port 1 Frame Fault flash has been modified to limit the number of times the device may exit this fault state in a specific time without user interaction.

SECTION 4:

Pin Assignments has been modified to add 'Local Flash Status' input on Connector B. This and the Output Relay modification are key to enabling the CU to enter Start-Up Flash following any Terminal & Facilities flash mode.

Output Relay operation has been modified to add 'Start-Up Flash Call' bit in Frame 129.

Display has been modified to add 'Local Flash Status' input indication.

Minimum Yellow Change / Red Clearance Interval Monitoring has been modified to remain enabled when the Load Switch Flash bit is set to 1 in the Type 0 frame from the CU.

Port 1 Timeout operation has been modified to limit the number of times the device may exit the fault state in a specific time without user interaction.

SECTION 5:

Port 1 Communication Cables shielding has been modified to terminate to Earth Ground.

Malfunction Management Unit wiring has been modified to add 'Local Flash Status' input.

SECTION 6:

Detector Configurations has been modified to add four new types (AC, BC, CC, & DC) with communications port TX & RX capability.

Detection Outputs & Status Outputs condition has been added for the Disable and Reset states.

Detector Connector Terminations has been modified to add Detector Address Bit #3.

SECTION 8:

BIU Configurations has been modified to add one new type (BIU2) with communications port TX & RX capability.

TS 2-2003 Update

The following is a summary of the changes provided by the 2003 release of this Standards Publication:

SECTION 3:

Page 54 : Clause 3.3.1.4.2.2 Type 129 MMU Inputs/Status (Type 1 ACK) - revised
Page 128 : Clause 3.9.3.1.3 Port 1 - revised

SECTION 5:

Page 163 : Clause 5.3.3 Port 1 Communication Cables - revised
Page 171 : Clause 5.4.2.1 Grounding System - revised

SECTION 6:

Page 198 : Table 6-2
CONNECTOR TERMINATIONS - revised

SECTION 8:

Page 206 : Clause 8.5 POWER REQUIREMENTS - revised
Page 206 : Clause 8.5.1 Initialization - revised
Page 207 : Clause 8.7.1 Communication Port Electrical Requirements - revised
Page 209 : Clause 8.8.4 Outputs - revised
Page 210 : Clause 8.8.4.1.4 TX Output Shorts - revised
Page 210 : Clause 8.8.5.2 Opto Inputs - revised
Page 211 : Clause 8.8.5.4 24 Volt Signal Inputs - revised
Page 211 : Clause 8.8.5.4.2 Function Inputs - revised
Page 212 : Clause 8.8.5.5 Data Receive Input (RX) for BIU Type BIU2 - revised

Revisions to this update are denoted by a line at the right border as shown for this paragraph. |