


TO: SUPERSEDED BY EB 01-030 EFFECTIVE 5/30/01	ENGINEERING INSTRUCTION NEW YORK STATE DEPARTMENT OF TRANSPORTATION
	SUBJECT: TIME BASE COORDINATION UNIT Subject Code: 7.27-1-680
Distribution: 31 Main Office 33 Regions 34 Special APPROVED:  <u>M. Tegza, Civil Engr. V. Final Plan Review Bureau</u>	Code: <u>EI 86-14</u> Date: <u>3/10/86</u> Supersedes:

Attached for use is a copy of a specification for Multiple Dial/Offset Time Based Coordination Units, Pay Item 15680.8088 "Time Base Coordination Unit".

These units eliminate the need for interconnection between individual signals in a coordinated system. These units use the line frequency provided by the local utility as their common time base. Time Base Coordination Units should be considered when it is determined that individual TBC units would be less than the cost of installing and maintaining interconnect cable.

The following list of items currently in use will be voided with issuance of this EI.

- | | |
|--------------|--------------|
| 08680.7807 | 08680.8089 |
| 08680.8036 | 03680.808905 |
| 02680.803701 | 03680.808906 |
| 02680.803801 | 03680.808907 |
| 02680.8040 | 08680.809010 |
| 02680.8041 | 08680.8098 |
| 05680.8089 | |

This EI will be effective with the letting of August 7, 1986.

Description:

Under this item the Contractor shall furnish and install a Time Base Coordination Unit and Cabinet, at the location shown on the plans and as directed by the Engineer.

General:

A. OUTPUT CIRCUITS

A minimum of eight outputs shall be provided as shown:

Sync (Synchronizing Pulse)
 Cycle 2 (Dial 2 Transfer) or Auxiliary
 Cycle 3 (Dial 3 Transfer) or Auxiliary
 Offset 2 (Offset 2 Select) or Auxiliary
 Offset 3 (Offset 3 Select) or Auxiliary
 Free (Or Auxiliary)
 Force Off 1
 Force Off 2

The Cycle 2, Cycle 3, Offset 2, Offset 3 and Free Outputs shall each be capable of being set to turn ON or OFF at any second during the year. The Sync Output shall provide a pulse once per traffic signal cycle and shall delay its pulse from the cycle "Zero Time" by the amount of offset value for the offset currently selected. Cycle "Zero Time" is the time a sync pulse would normally start, if it was not offset.

The Force Off 1 and Force Off 2 Outputs are similar to the Sync Output providing a pulse once per cycle for force off. Each of these outputs shall be capable of being programmed to turn ON or OFF at any second of the cycle. Synchronizing and force-off signals generated by the unit shall be dependent on time only and not on events.

Each Output shall utilize optically isolated transistor coupling.

1. Voltage (collector to emitter): 30 VDC maximum
2. Current: 15.0 milliamps sink maximum
3. Saturation voltage: 1.0 VDC maximum
4. Isolation 1500 V

1. Programming

The unit shall contain memory for storage of timing data and shall be manually programmable by the user from the front panel. Data entry and readout shall be functionally related to their end use in generating timed outputs.

Each unit shall be programmable to provide outputs for control of:

- a. Sync or Offset
- b. Cycle (Dial)
- c. Hold/Yield/Force Off
- d. Special Functions (Intersection Flash, Changeable Signs, etc.)

2. Program Transfer

Means shall be provided to enter into a Time Based Coordinator complete program information including clock time through a plug type electrical connection to a portable programming unit. The portable programming unit may be a special programming unit, other Time Based Coordinator or an EPROM. The portable unit shall be capable of maintaining the program to allow entering and verifying the proper information into any number of Time Based Coordinator Units successively. The entry of the information shall be accomplished automatically and shall be capable of accomplishment in the field to program or reprogram installed Time Based Coordinators without their being disconnected or removed from the traffic control cabinet in which they are installed. Total program transfer time shall not exceed one minute.

3. Access Code

The unit shall have means to prevent unauthorized operators from altering, erasing or entering data. The operator shall be required to enter a predetermined number sequence or combination before data can be altered, erased or entered. Without entering the proper access code, the operator shall be limited to the observation only of the unit's clock and sorted data. As an alternative instead of an access code to prevent unauthorized clock changes, data entry, data change or data clear, a key-switch may be provided. The key shall be removable only when in the locked position.

4. Program Capability

The unit shall be capable of the following as a minimum:

- a. Twenty-four program events a day
- b. Ten day-programs
- c. Five week-program
- d. One year-program
- e. Ten exception days to the year program

5. Definitions

- a. A time is the week-of-year; day-of-week; and hour, minute and second of the day.
- b. A program event is the switching (ON or OFF) of any possible combination of outputs.
- c. A day program is a list of program events which are to occur at each specified time during a day.
- d. A week program specifies the day program that shall be used on each day of the week.
- e. The year program specifies the week program that shall be used during each week of the year.
- f. Year program exceptions are a list of day programs that will be used on specific days of the year. On those days, a day program other than that called for by the year program will be used. The same exception day program may be used on different specified days.

B. FUNCTIONS

1. Calendar

The unit shall contain a one year (52 week) clock that can be readily set to the nearest week, day, hour, minute and second of the year. The clock shall display the week, day, hour, minute and second of the year.

The clock shall use the power line frequency as a time base when 60 Hertz AC power is present and a back-up battery powered temperature compensated oscillator when the power is interrupted. The back-up source shall have an accuracy of ± 50 parts per million or better and shall have an adjustment to correct for a minimum 10 year aging life.

The unit's output signals shall be based on user programmed time-of-year entries. These output signals shall be suitable to produce sync, dial transfer, offset change, hold, force off, yield, phase omit, pedestrian omit and similar commands.

Timing shall be accomplished by digital methods and shall utilize power line frequency as a primary base. The digital timing shall normally be locked to the power line frequency so that no cumulative or drift errors will occur in timing intervals between the unit and the power line, or between units on the power line.

2. Basic Capability

The unit shall be capable of generating output signals for the control of its associated traffic signal controller. These output signals shall cause the associated local signal controller to operate in such a manner as to achieve coordinated operation with adjacent intersections on the basis of their timing accuracy without any physical interconnection. The unit shall have a number of outputs permitting change of the system signal patterns at times as programmed in the unit. An output program shall be capable of being initiated at any time.

3. Display

The unit shall be capable of displaying any of its stored information and having that information altered, erased or replaced by operation of the unit's front panel controls. The display shall be easily readable outdoors under any environmental condition.

The unit shall be capable of displaying the following:

- a. Clock Data (week-of-year, day-of-week, hour, minute and second shall be displayed simultaneously).
- b. Timing Data.
- c. Current Output Status.
- d. Operational Status of Unit.

C. CLOCK SPECIFICATIONS

The clock shall operate on a 52 week, 7-day week and 24-hour day basis.

The clock shall be easily adjusted to the nearest second of the year. The clock shall cause the digital display to simultaneously show the week-of-year, day-of-week, hour, minute and second of the day.

When the unit is ON and line voltage is present, the 60 Hertz frequency of the line voltage shall be the basic time reference for the clock. The clock shall pass the timing accuracy test under the conditions for power service and transients in NEMA Traffic Controller Standards Publication No. TSI-1976, as currently revised (Appropriate Section is TSI-2).

An internal oscillator shall be provided to maintain time when on standby power during a line voltage power loss. The clock accuracy shall be 50 parts per million or better when it is on standby power over the full operating temperature and battery voltage range for the design life of the battery. Correct time must be maintained during power outages of up to a minimum of 100 hours.

D. OUTPUT SPECIFICATIONS

All outputs shall change state based on clock time as commanded by stored timing data.

The outputs shall be programmable to perform the following timing and operational controls:

Sync
Cycle 2 (Dial 2 Transfer) or Auxiliary
Cycle 3 (Dial 3 Transfer) or Auxiliary
Offset 2 (Offset 2 Select) or Auxiliary
Offset 3 (Offset 3 Select) or Auxiliary
Free or Auxiliary
Force Off 1
Force Off 2

1. The width of the sync pulse shall be a minimum of 3 seconds.
2. A sync pulse shall occur once each cycle at any second when programmed. Cycle length shall be programmable over a minimum range of 40 to 240 seconds in 1 second increments. It shall be possible to have the cycle length determined by the programming of cycles 2 and 3. When such is the case, the cycle in effect shall be determined by the status of the Cycle 2 and Cycle 3 Outputs.
3. The sync pulse shall be capable of being programmably offset from system "Zero Time" reference by the value of offset selected. The offset values may be set from 1 to 240 seconds in one second increments.

Force Off 1 and Force Off 2 shall be capable of being set from 1 to 10 seconds in 1 second increments.

The force-off pulse(s) shall occur once in each cycle and shall have the capability to be set anywhere within the cycle in 1 second increments.

The Cycle 2, Cycle 3, Offset 2, Offset 3 and Free Outputs shall be capable of being set to switch ON or OFF at any second of the year.

E. OTHER OPERATIONS

The unit shall include the following:

1. To prevent accidental and unauthorized changing of stored coordination plans, it shall be necessary to enter an access code before memory can be changed. As an alternative, a key switch may be provided instead of an access code to prevent unauthorized entry into the data banks. It shall be possible to remove the key only when it is in the lock position.

2. It shall be possible to read the clock and all data stored without entering the memory access code.
3. A switch shall be provided to disconnect the standby battery. It shall not be possible to accidentally activate this switch. When line power is applied, an indication shall be provided to indicate the battery switch status.
4. Removal of the unit from the control cabinet shall allow the local controller to operate without coordination.
5. The unit shall have the capability of making automatic correction for Daylight Savings Time and back to Standard Time at user programmed times.

F. ENVIRONMENTAL SPECIFICATIONS

The unit shall perform to the environmental and operating conditions as per the following sections of the NEMA Standards Publication No. TS1-1976 for traffic control systems:

TS 1-2.2.01	Operating Voltage, Frequency and Power Interruption
TS 1-2.1.02	Voltage
TS 1-2.1.03	Frequency Range
TS 1-2.1.05	Temperature and Humidity
TS 1-2.1.06	Transients, Power Service
TS 1-2.1.07	Transients, Input/Output Terminals
TS 1-2.1.14	Vibration
TS 1-2.1.15	Shock

G. PHYSICAL SPECIFICATIONS

The size of the unit including connectors and protrusions shall not exceed 14 inches in height by 13 inches in width by 9 inches deep and shall be capable of operating in any orientation.

All inputs and outputs shall enter the unit through a front panel mounted MS type connector.

The unit shall be designed to facilitate the isolation and correction of faults. All circuit boards shall be readily accessible and shall be connector mounted.

All printed circuit boards shall be made from NEMA G-10 or G-11 glass-epoxy, flame retardant, or equivalent. Circuit boards shall be at least 1/16" nominal thickness. Plated-through holes shall have a copper plating equivalent of 1 ounce per square foot of copper. All circuit tracks shall have a conductivity equivalent to at least 2 ounces of copper per square foot of board. All edge and front panel connectors shall be made of non-corrosive material.

All material used in constructing the unit shall be corrosion resistant.

H. PRODUCT ACCEPTANCE TEST

Manufacturer shall certify that test results have met the conditions described in these specifications.

A standard production unit shall be used for the test.

The unit shall be tested to the appropriate sections of the standards as outlined in the NEMA Standards Publication No. TS1-1976 for traffic control systems:

TS 1-2.2.03	Transient, Temperature, Voltage and Humidity
TS 1-2.2.05	Vibration
TS 1-2.2.06	Shock
TS 1-2.2.07	Power Interruption

In addition, the unit shall be capable of maintaining accurate time and memory when AC power is provided to the unit and then disrupted and re-established repeatedly and in rapid succession for at least ten seconds.

I. OPERATING MANUAL

The manufacturers of a Time Based Coordinator shall supply an "Installation, Operation, Service and Maintenance Manual" with each Time Base Coordination Unit which will provide installation and operating instructions for the programmer and instructions that will aid service personnel in easy detection of failures, analyzing the symptoms and performing corrective measures that will restore the unit to satisfactory operation.

One mylar and three prints shall be supplied with each Time Base Coordination Unit detailing wiring connections in the Time Base Coordination Unit Cabinet and to the signal controller.

J. CABINET

The Time Base Coordination unit shall be housed in a cabinet with the minimum dimensions of 10" deep, 15" wide and 20" high.

Construction Details:

The requirements of Section 680.3 of the Standard Specifications shall apply with the following additions:

1. The Time Base Coordination Cabinet shall be mounted at the same location as the Controller or Microcomputer Cabinet, either on the pole or attached to the existing cabinet as directed by the Engineer.
2. The installation, programming and testing of the Time Base Coordination must be done by qualified personnel and as directed by the Engineer.

Basis of Acceptance:

Acceptance of the Time Base Coordination Unit will be based on the manufacturer's certification of compliance with these specification requirements and the manufacturer's certification that test results have met the conditions described in paragraph H. of these specifications.

Method of Measurement:

The quantity to be paid for under this item shall be the number of Time Base Coordination Units furnished and installed in accordance with the plans, specifications and as directed by the Engineer.

Basis of Payment:

The unit price bid shall include the cost of the Time Base Coordination Unit, interface logic, cabinet, all attachments, incidental fixtures, fitting, material, labor, installation, programming, testing and tools necessary to complete the work.