

Revision Amendment 1 to NTCIP 1205 v01.08

National Transportation Communications for ITS Protocol

Object Definitions for Closed Circuit Television (CCTV) Camera Control

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This amendment is a set of proposed changes to NTCIP 1205:2001 v01.08, and that if jointly approved, will be published as an incremented minor version of major version v01. Because the proposed changes are located throughout the NTCIP 1205 v01.08 standards publication, the proposed Amendment 1 changes are presented by strikethrough (proposed deletions) and underline text (proposed additions), and identified by marginal change bars.

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- California Department of Transportation
- Cohu, Inc.
- Diamond Electronics, Inc.
- Federal Highway Administration
- ~~Gardner Transportation Systems, Inc.~~
- [G. C. Herrick & Associates, Inc.](#)
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- Washington State Department of Transportation

FOREWORD

This document uses only metric units.

This document defines the Closed Circuit Television (CCTV) data elements, or objects, that are supported by the NTCIP.

The text includes an extended glossary in Annex A that is defined as informative.

For more information about NTCIP standards, visit the NTCIP Web Site at <http://www.ntcip.org>. For a hardcopy summary of NTCIP information, contact the NTCIP Coordinator at the address below.

In preparation of this NTCIP document, input of users and other interested parties was sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to:

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Approvals

This document was separately balloted and approved by AASHTO, ITE, and NEMA after recommendation by the Joint Committee on the NTCIP. Each organization has approved this standard as the following standard type, as of the date:

AASHTO – Standard Specification; February 2001
ITE – Software Standard; May 2001
NEMA – Standard; July 2001

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History

From 1997 to 1999, this document was referenced as TS 3.CCTV. However, to provide an organized numbering scheme for the NTCIP documents, this document is now referenced as NTCIP 1205. The technical specifications of NTCIP 1205 are identical to the former reference, except as noted in the development history below:

TS 3.CCTV v98.01.03. August 1998 – Accepted as a User Comment Draft by the Joint Committee on the NTCIP. October 1998 – Distributed by NTCIP Standards Bulletin B0028 for user comment.

NTCIP 1205 v01.07. July 1999 – Version 01.06 accepted as a Recommended Standard by the Joint Committee on the NTCIP. August 2000 – Version 01.07 attached to NTCIP Standards Bulletin B0055 included typographic corrections. Approved by AASHTO in February 2001, approved by ITE in May 2001, and approved by NEMA in July 2001.

NTCIP 1205:2001 v01.08, December 2001. January 2002 – Formatted for printing: updated title page date and version number; and revised the front matter to conform to NTCIP 8002. All references to TS 3 standard number were changed to equivalent NTCIP standard numbers.

INTRODUCTION

The purpose of this document is to define the Closed Circuit Television (CCTV) Camera Control objects that are supported by the NTCIP.

The NTCIP Object Definitions for Closed Circuit Television (CCTV) Camera Control defines objects in ASN.1 using the SNMP Object Type Macro for devices that sense the presence or similar characteristics of vehicles. These definitions are intended for CCTV camera control devices.

This standard defines requirements that are applicable to all NTCIP environments and it also contains optional and conditional clauses that are applicable to specific environments for which they are intended.

The following keywords apply to this document: AASHTO, ITE, NEMA, NTCIP, CCTV, camera control, objects.

In 1992, the NEMA 3-TS Transportation Management Systems and Associated Control Devices Section began the effort to develop the NTCIP. ~~The Transportation Section's purpose was to respond to user needs to include standardized systems communication in the NEMA TS 2 standard, Traffic Controller Assemblies.~~ Under the guidance of the Federal Highway Administration's NTCIP Steering Group, the NEMA effort was expanded to include the development of communications standards for all transportation field devices that could be used in an Intelligent Transportation Systems (ITS) network.

In September 1996, an agreement was executed among AASHTO, ITE and NEMA to jointly develop, approve, and maintain the NTCIP standards. In August 1997, the Working Group was first organized to develop data element definitions for Closed Circuit Television camera control. Under the guidance of the Joint AASHTO/ITE/NEMA Committee on the NTCIP, a Working Group was formed to develop the object definitions for Closed Circuit Television camera control. The CCTV WG first met in August 1997.

~~The NTCIP Object Definitions for Closed Circuit Television (CCTV) Camera Control defines objects in ASN.1 using the SNMP Object Type Macro for devices that sense the presence or similar characteristics of vehicles. These definitions are intended for CCTV camera control devices.~~

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CONTENTS

Section 1 CCTV OVERVIEW	1-1
1.1 Introduction TO CCTV	1-1
1.2 Benefits of standardization	1-1
1.3 Existing Standards	1-2
1.3.1 Internet Standards	1-3
1.3.2 International Organization of Standardization Standards	1-3
1.3.3 NTCIP	1-3
1.3.4 NTCIP System Design	1-3
1.4 Closed Circuit Television	1-3
1.4.1 Discussion of CCTV Coordinate Systems	1-5
1.4.2 Discussion of Limit Stops in CCTV Systems	1-7
Section 2 GENERAL	2-1
2.1 Scope	2-1
2.2 References	2-1
2.2.1 Normative References	2-1
2.2.2 Other References	2-1
2.2.3 Contact Information	2-2
2.3 Terms	2-2
2.4 Acronyms	2-4
2.5 Supplemental figures	2-5
Section 3 CCTV MIB	3-1
3.1 Closed Circuit Television (CCTV) Objects	3-1
3.2 CCTV Range Objects	3-2
3.2.1 Maximum Number of Presets Parameter	3-2
3.2.2 Pan Left Limit Parameter	3-3
3.2.3 Pan Right Limit Parameter	3-3
3.2.4 Pan Home Position Parameter	3-3
3.2.5 True North Offset Parameter	3-3
3.2.6 Tilt Up Limit Parameter	3-3
3.2.7 Tilt Down Limit Parameter	3-4
3.2.8 Zoom Limit Parameter	3-4
3.2.9 Focus Limit Parameter	3-4
3.2.10 Iris Limit Parameter	3-4
3.2.11 ~~Maximum~~ Minimum Pan Step Angle Parameter	3-5
3.2.12 ~~Maximum~~ Minimum Tilt Step Angle Parameter	3-5
3.3 CCTV Timeout Objects	3-5
3.3.1 Pan Timeout Parameter	3-5
3.3.2 Tilt Timeout Parameter	3-5
3.3.3 Zoom Timeout Parameter	3-6
3.3.4 Focus Timeout Parameter	3-6
3.3.5 Iris Timeout Parameter	3-6
3.4 CCTV Preset Objects	3-6
3.4.1 Go To Preset Position Parameter	3-6
3.4.2 Store Preset Position Parameter	3-6
3.5 CCTV Positioning Objects	3-7
3.5.1 Pan Position Parameter	3-7
3.5.2 Tilt Position Parameter	3-7
3.5.3 Lens Zoom Position Parameter	3-7
3.5.4 Lens Focus Position Parameter	3-8
3.5.5 Lens Iris Position Parameter	3-8

3.6	CCTV System Feature Control Objects	3-9
3.6.1	System Camera Feature Control Parameter	3-9
3.6.2	System Camera Feature Status	3-10
3.6.3	System Camera Equipment Availability Parameter	3-10
3.6.4	System Lens Feature Control Parameter	3-10
3.6.5	System Lens Feature Status Parameter	3-11
3.6.6	System Lens Equipment Availability Parameter	3-11
3.7	CCTV Alarm Objects	3-11
3.7.1	Alarm Status Parameter	3-11
3.7.2	Alarm Latch Status Parameter	3-12
3.7.3	Alarm Latch Clear Parameter	3-12
3.7.4	Temperature Alarm High-Low Threshold	3-12
3.7.5	Temperature Alarm Current Value Parameter	3-13
3.7.6	Pressure Alarm High-Low Threshold Parameter	3-13
3.7.7	Pressure Alarm Current Value Parameter	3-13
3.7.8	Washer Fluid Alarm High-Low Threshold Parameter	3-13
3.7.9	Washer Fluid Alarm Current Value Parameter	3-14
3.7.10	Alarm Label Index Parameter	3-14
3.8	CCTV Discrete Input Objects	3-14
3.8.1	Discrete Input Status Parameter	3-15
3.8.2	Discrete Input Latch Status Parameter	3-15
3.8.3	Discrete Input Latch Clear Parameter	3-15
3.8.4	Discrete Input Label Index Parameter	3-16
3.9	CCTV Discrete Output Objects	3-17
3.9.1	Discrete Output Status Parameter	3-17
3.9.2	Discrete Output Control Parameter	3-17
3.9.3	Discrete Output Label Index	3-18
3.10	CCTV Zone Objects	3-18
3.10.1	Maximum Number of Zones Parameter	3-18
3.10.2	Zone Table	3-18
3.11	CCTV Label Objects	3-21
3.11.1	Maximum Number of Labels Parameter	3-21
3.11.2	Label Table	3-21
3.11.3	Label Location Parameter	3-24
3.11.4	Enable Label Text Display	3-25
3.12	CCTV On-Screen Camera Menu Objects	3-25
3.12.1	Activate Menu Parameter	3-25
3.12.2	Menu Control Parameter	3-25
	Section 4 CONFORMANCE	4-1
4.1	Conformance Groups	4-1
4.1.1	CCTV Configuration Conformance Group	4-2
4.1.2	Extended Functions Conformance Group	4-2
4.1.3	Motion Control Conformance Group	4-3
4.1.4	On-Screen Menu Control Conformance Group	4-4
4.2	Conformance Statements	4-4
	Annex A EXTENDED GLOSSARY	A-1

Section 1 CCTV OVERVIEW

1.1 INTRODUCTION TO CCTV

The context of the NTCIP is one part of the Intelligent Transportation Systems (ITS) standardization activities covering base standards, profiles, and registration mechanisms.

- Base Standards define procedures and rules for providing the fundamental operations associated with communications and information that is exchanged over fixed-point communications links.
- Profiles define subsets or combinations of base standards used to provide specific functions or services. Profiles prescribe particular subsets or options available in base standards necessary for accomplishing a particular function or service. This provides a basis for the development of uniform, nationally recognized conformance.
- Registration Mechanisms provide a means to specify and uniquely identify detailed parameters within the framework of base standards and/or profiles.

Other working groups of the Joint AASHTO/ITE/NEMA Committee on the NTCIP are concerned with the methodology of defining profiles, and their documentation in Standards Publications. The objective is to facilitate the specification of ITS systems characterized by a high degree of interoperability and interchangeability of its components.

This document covers the control and status requirements of cameras, lenses, pan/tilt units. Video switches are an integral part of many CCTV systems, however, NTCIP standards for controlling video switches will be issued as a separate standards document. A CCTV Camera Control subsystem is comprised of an assembly of camera, lens, and pan/tilt functions.

There are no existing standards that define how these devices communicate with other related equipment. As a result, each manufacturer has developed its own protocol to meet their particular needs. To integrate systems manufactured by different companies, considerable extra work must be performed resulting in increased costs. This shortcoming limits interchangeability of components between different vendors and restricts the sharing of information and control within and between user organizations.

These problems have not been limited to CCTV surveillance systems. Many other devices also need to share network infrastructure and exchange information. In surface transportation, examples include traffic signal controllers, dynamic message signs, bus priority sensors, etc. To address these problems, the NTCIP is developing a family of open standards for communications among field devices and between field devices and central management stations, known as Traffic Management Subsystems (TMS).

The NTCIP CCTV standard describes objects that control the camera subsystem. As previously mentioned, objects that control video switches will be issued under separate cover.

1.2 BENEFITS OF STANDARDIZATION

As transportation systems become more sophisticated, planners, users, and equipment manufacturers recognize the need for system interoperability and integration. Currently, there is no common protocol with which different types of equipment can communicate. If CCTV is to be integrated with ITS, common communications standards must be established.

Before the NTCIP development started, each vendor of electronic devices used in transportation adopted

a different protocol for data communications. This made it very difficult to mix equipment from different vendors in the same system, and to communicate between systems operated by adjacent agencies. The NTCIP is now providing a common standard that can be used by all vendors.

The NTCIP offers increased flexibility and choice for agencies operating traffic management systems. It removes barriers to inter-jurisdictional coordination and allows equipment of different types and manufacturers to be mixed on the same communications line. For these reasons, operating agencies will benefit from specifying that the NTCIP is included in all future purchases and upgrades.

Benefits of adopting open standards based on the NTCIP include:

- *Avoiding Early Obsolescence:* Though it may not be practical to retrofit NTCIP support in some old equipment, most CCTV vendors will offer NTCIP support in current and future products. An operating agency can ensure that its equipment remains useful and compatible long into the future by requiring NTCIP support for all future purchases and upgrades. This will include central computers and CCTV field devices, such as cameras, pan/tilt mechanisms, lens, and video switchers.
- *Providing Choice of Vendor:* Once an agency has a CCTV surveillance system that includes support for NTCIP it can buy field devices from any manufacturer offering NTCIP-compatible products, and they will communicate with the agency's "Traffic Management Subsystem" ('TMS', typically termed CPU).
- *Allowing Interjurisdictional Coordination:* In the future, an agency may want to communicate with CCTV devices owned by other users and/or procured from different vendors. Under NTCIP, these various devices can be added onto an existing communications channel and mixed with different types of devices on the same line.
- *Using one Communications Network for All Devices:* NTCIP also allows a central computer to communicate with a range of field devices on the same communications channel. For example, if a dynamic message sign is installed near a CCTV camera control receiver, the central computer could communicate with the sign controller using the communications channel already in place for the CCTV camera control receiver. The communications network is usually the most expensive component of a transportation management system and use of the NTCIP maximizes that investment.

Several state and local transportation agencies already have a number of CCTV surveillance systems deployed for traffic and transportation management. At present, however, these systems often include proprietary elements that limit expansion and upgrade opportunities.

The development of the NTCIP will allow a more open-systems approach, not only among CCTV equipment, but also with a wide variety of other field devices. It is expected that this open-systems approach will result in lower deployment and equipment costs similar to the PC industry. This in turn will allow for more devices to be deployed resulting in better decision-support to decrease maintenance costs.

To make best use of these advancements, CCTV should be viewed in the much broader context of Intelligent Transportation Systems (ITS). The key to these benefits is open standards, allowing agencies to share data and avoid becoming locked into proprietary systems.

1.3 EXISTING STANDARDS

There are great benefits of adopting existing standards where possible. These include:

- reuse of software modules during development
- faster implementations
- reducing risks
- ability to integrate components from different manufacturers
- unambiguous meanings of terminology
- building on proven technologies

1.3.1 Internet Standards

The Internet Engineering Task Force (IETF) is responsible for developing and maintaining the standards, guidelines and procedures for communications over the Internet. This group has become increasingly important over the last few years as the Internet has gained popularity. A wide range of Internet standards exist, including:

- Point-to-Point Protocol (PPP) - which may be used for NTCIP dial-up links
- Internet Protocol (IP) - which may be used for NTCIP communications over networks
- Transport Control Protocol (TCP) - which may be used to provide connection-oriented transport services over NTCIP networks
- User Datagram Protocol (UDP) - which may be used to provide connectionless transport services over NTCIP networks
- Simple Network Management Protocol (SNMP) - which may be used to exchange NTCIP data elements such as those defined within this document.

1.3.2 International Organization of Standardization Standards

The International Organization of Standardization (ISO) also develops various communication standards among a wide variety of other standards. The Open Systems Interconnect Reference Model (OSI) is a widely-referenced ISO standard which defines the standard seven-layered communications model. While most implementations do not strictly conform to this standard, virtually all modern communications schemes, including the NTCIP, use many of the concepts defined within the standard. In addition, NTCIP communications may use the High Level Data Link Control Protocol (HDLC), another ISO standard, in specifying how to send a message over a single communications link.

1.3.3 NTCIP

To support ITS developments, US DOT funded the design of a National ITS Architecture. This architecture defines major ITS subsystems and the needs for information exchange among them. The National Transportation Communications for ITS Protocol (NTCIP) group is now developing standards for these information exchanges. NTCIP – a joint initiative of AASHTO, ITE, and NEMA – recognizes that closed circuit television is a vital component of traffic and transportation management systems. The family of NTCIP standards will enhance CCTV implementation and provide a mechanism for the manipulation of the basic camera control functions within CCTV systems.

1.3.4 NTCIP System Design

NTCIP was initially designed to support traffic signal controllers because that was seen by the FHWA as an area of most pressing need. However, the development process planned that the protocol would be extended to other transportation environments (e.g., ITS) and, where appropriate, to other environments.

The NTCIP family of protocols is continually expanding to address additional needs. Work is in progress on additional protocols for computer-to-computer or center-to-center data exchange, transit communications, and communications with or between moving vehicles. The NTCIP, along with other US DOT standards efforts, will eventually provide a comprehensive family of communications protocols covering all appropriate ITS applications.

There may also be a future demand to use the system for communications to field devices that are not transportation related. The ultimate scope of NTCIP cannot be rigidly determined. The key is to determine how those changes might affect the system design and to provide flexible standards that accommodate these changes. NTCIP will seek to utilize existing telecommunications and computer industry standards to the extent possible.

1.4 CLOSED CIRCUIT TELEVISION

Closed Circuit Television (CCTV) is a method of distributing video signals such that access to said signals is confined to devices directly connected to a common circuit or system. By contrast, broadcast

television signals are available to an unlimited number of receivers, and access to such signals cannot easily be restricted or controlled.

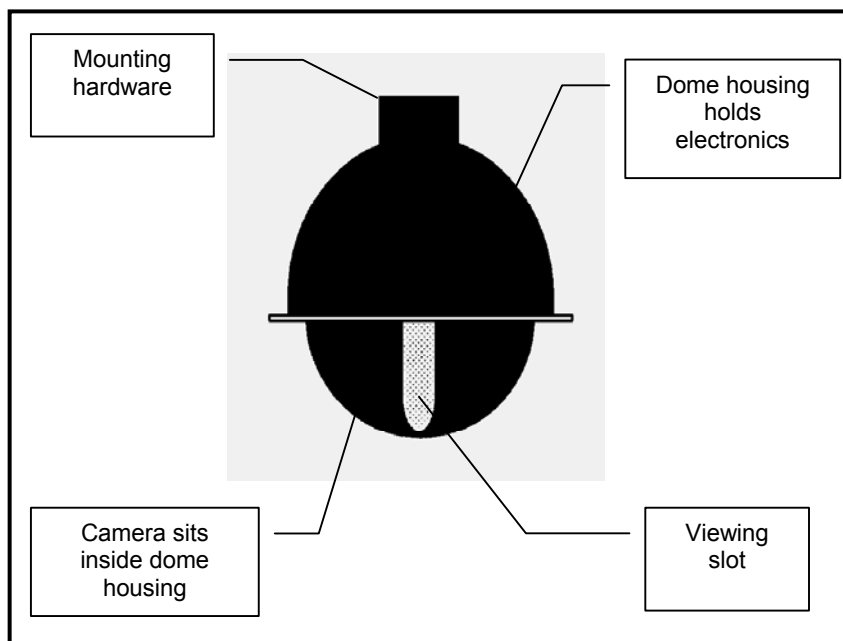
CCTV video information is then normally transmitted within a closed system through a restricted-access medium in the form of signals conforming to the RS170 standard for video signaling. This signaling is characterized by the combination of a voltage-encoded video luminance (brightness or intensity) signal, a color signal encoded on an amplitude-and-phase-modulated carrier, and additional voltage encoded synchronization signals. Since the luminance and synchronization signals are not modulated, RS170 video is referred to as "base-band video". Also because the brightness, color and synchronization signals are combined onto a single wire, RS170 is characterized as "composite video". By contrast, broadcast TV signals are also composite video, but are amplitude modulated onto pre-established frequency carriers to permit transmission of multiple channels over a common medium.

Each base-band, composite video signal in a CCTV system is normally transmitted over a dedicated coaxial cable. However, CCTV signals are often modulated and/or combined for transmission over fiber optics cables or other access-secured transmission media to increase transmission distances or to achieve cost savings.

Video signal transmission is currently outside the scope of the NTCIP. Standards for video transmission may be added at some later date, but will not be discussed in this document. In addition to the video signal, CCTV systems provide a data communications connection between the traffic management center and field devices for the purpose of manipulating camera position, lens adjustment, and video switching. Camera positioning includes panning the camera in the horizontal plane both right and left, and tilting the camera in the vertical plane both up and down. Lens adjustments include zoom adjustments for wide and telephoto, focus adjustments for both far and near, and iris adjustments for both closed and open. Video switching devices provide a mechanism for manipulating input and output assignments to effectively utilize available network capacity. This document specifically addresses the data communications link between the traffic management center and the field devices that is used for the camera control.

For simplicity, the control of the pan/tilt unit, lens, and camera will be assumed to use the same physical channel and target control processor called a camera control receiver. The camera control receiver receives the data communication and generates the necessary control signals for individual CCTV components such as the lens. The concept of the camera control receiver does not preclude each CCTV device from directly processing the NTCIP messages, as system architecture can vary among manufacturers.

The number of camera adjustment features has increased dramatically as new technology continues to press the video surveillance industry. Today's CCTV systems have a diverse set of features that vary depending on manufacturer. A basic array of these features covering configuration, motion and lens control, alarms, inputs, outputs, labels, camera menu manipulation, and the video switch are supported by the NTCIP standards.



The NTCIP CCTV Camera Control standard describes objects that control the camera subsystem. As previously mentioned, objects that control video switches will be issued under separate cover.

1.4.1 Discussion of CCTV Coordinate Systems

There are two CCTV coordinate systems referenced in this standard. The horizontal coordinate system is used for pan positioning and the vertical coordinate system is used for tilt positioning.

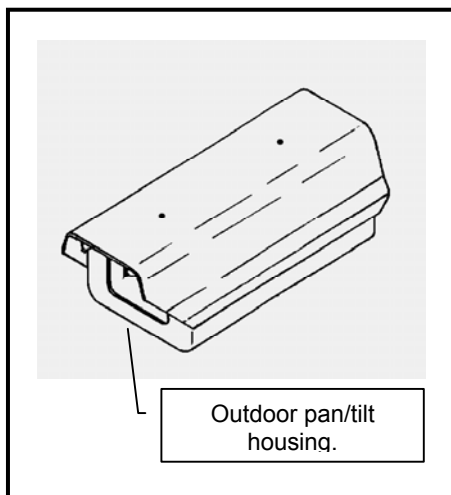
1.4.1.1 Horizontal Coordinate System

A dome CCTV camera enclosure has a clear viewing slot that can be rotated, or “panned”, to a user selected viewing position. To be able to repeat positions, the dome has the ability to measure the direction that the camera is pointing.

The mechanism that controls the pan and tilt movement will have a “home” position, or a “native” zero. The home location depends on how the device was installed, as the device could be pointing in any direction.

This means that, if the pan mechanism is told to go to an angle of 30 degrees, it will comply but the operator will not know where that position really is located. If the equipment is installed so that the dome’s native coordinate system is aligned with a local, or global, coordinate system, that will solve the direction problem.

Unfortunately, another problem also exists. Circular movement is most often discussed in terms of degrees. A circle is divided into 360 degrees. Unfortunately, a pan/tilt mechanism is very unlikely to have the same units of measurement. A pan device might, for example, have a pan movement that is controlled through 256 steps, or divisions, within a circle. The number of steps might also be defined as 641, or some other vendor specific value.



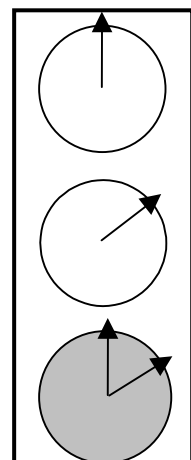
This standard seeks to resolve these problems by describing a reference between the coordinate system of the device and some other local or global coordinate system. The following two-step solution for resolving the coordinate system dilemma is employed by this standard:

1. Provide for a standard conversion mechanism to convert between a pan/tilt device’s native coordinate system and a local or global coordinate system.
2. Specify and use a universal measurement system, which in this case is defined as degrees.

An example should help to make this clear. Let’s suppose that a new pan/tilt mechanism has just been installed. The coordinate system at the device level is fine for use, but there is a

need for the device to recognize true north (a global coordinate system in this case) as being 0 degrees.

When we look down on the object from above, true north is in the direction shown in the top illustration circle.



Unfortunately, the device as installed, regards the direction shown in the middle illustration circle as being the direction of 0 degrees (also known as the Home Position). Let us assume for the purposes of this example that the Home Position is located 60 degrees clockwise from True North.

To make the coordinate system of the pan/tilt mechanism match the true north direction, the device must be told what the difference, or True North Offset, is between the direction of actual true north and the direction that the device recognizes as 0 degrees. In the example shown, the device would be told that the true north offset is ~~+60~~ 300 degrees away from the native 0 degrees heading.

One way of performing this exercise with field equipment might be to aim the device toward true north and then tell the device that here is the location of what I want to call 0 degrees. ~~The device can then remember that offset value.~~ The management system can request the value of True North Offset from the device and make the necessary calculations to determine the appropriate reference from the Home Position.

From that time forward, the ~~device will~~ management station will perform a conversion on any position references that it ~~hears~~ receives, and reference any movement from the Home Position. If the operator ~~sends a request~~ wants to move the camera to a heading of 270 degrees from true north, the management station will request the value of the True North Offset ~~the device will receive that heading,~~ add ~~60~~ 300 degrees to it (giving a local reference heading of ~~330~~ 210 degrees), and direct the device to go to that heading. The calculations are described as follows:

- True North = 0 degrees for the global coordinate system;
- Home Position = 0 degrees for the device coordinate system, but it is really located at 60 degrees for the global coordinate system;
- The True North Offset is calculated as the difference from the Home Position to True North measured in the clockwise direction, and this value is 300 degrees (a complete circle at the Home Position is 360 degrees less the 60 degree difference between True North and the Home Position;
- To move to a position of 270 degrees from True North on the global coordinate system, the device would have to be moved 210 degrees from the Home Position on the device coordinate system (start with 300 degrees of True North Offset and add 270 degrees, however we have completed an entire revolution of the circle and must now subtract 360 degrees to give the local reference heading of 210 degrees).

This offset allows the user to establish an arbitrary frame of reference for the pan/tilt mechanism.

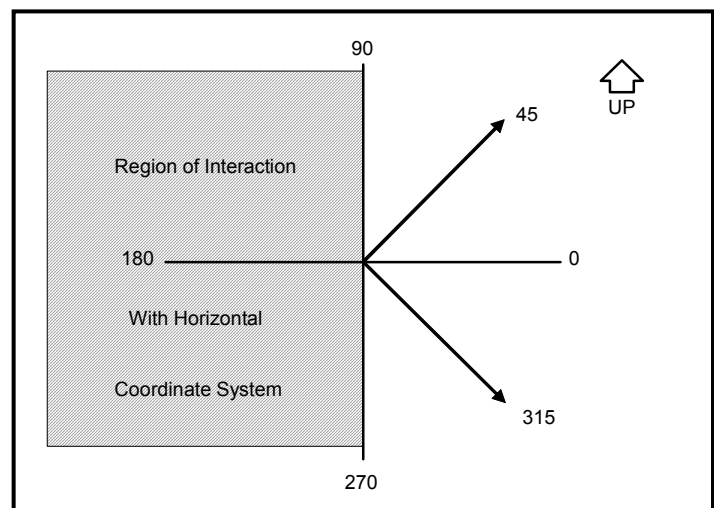
This standard employs a single measurement format for universally describing horizontal and vertical positioning. The measure chosen is hundredths of degrees. All pan/tilt devices must accept measures that are in the range 0.00 degrees to 359.99 degrees.

Most devices will not be capable of this degree of accuracy nor will they necessarily divide a circle up into 360 even steps. The manufacturer is responsible for rounding to the appropriate nearest level of accuracy and for converting to (as nearly as possible) a circle measured in degrees.

These conversions provide for a common interface that will ensure system level interoperability.

1.4.1.2 Vertical Coordinate System

The vertical coordinate system is based upon a 360 degree circle on a vertical plane that extends through the camera's movement point and the center of the earth. The zero point for measurement is any point on the



horizontal plane. The horizontal plane is orthogonal to the vertical line extending from the camera's movement point and the center of the earth. Tilting upward indicates a positive direction of movement. The figure to the right shows the vertical coordinate system.

With the definition of the zero point of measurement for the vertical coordinate system being any point along the horizontal plane, there is an interaction between the horizontal and vertical coordinate systems. As a result of this interaction, queries for tilt position are always returned as values between 270 degrees to 359.99 degrees and 0 degrees and 90 degrees. This means that if the camera direction points to a position behind the vertical line, the horizontal coordinate system must be adjusted by 180 degrees in order to compensate for the new camera tilt direction reporting criteria. An example of horizontal and vertical coordinate system interaction is given, as follows:

- Start with the pan position of the camera pointing in the direction of the Home Position with a True North Offset being zero (0) degrees, resulting in a horizontal coordinate system value of zero (0) degrees;
- The tilt position of the camera is pointing in the direction of 345 degrees (45 degrees below the horizontal plane);
- The queries for camera position are reported as zero (0) degrees in the horizontal coordinate system and 345 degrees in the vertical coordinate system;
- The camera tilt position is then moved to a point of 225 degrees (45 degrees below the horizontal plane, but behind the vertical line through the camera's movement and the center of the earth) while the pan position remains at a value of zero (0) degrees;
- At the point in which the the tilt position passes through the vertical line through the camera's movement and the center of the earth, the horizontal coordinate system must be adjusted such that the camera tilt position can be reported as values between 270 degrees to 359.99 degrees and 0 degrees and 90 degrees.
- The resulting camera position would be reported as 180 degrees from the Home Position in the horizontal coordinate system and 345 degrees in the vertical coordinate system.

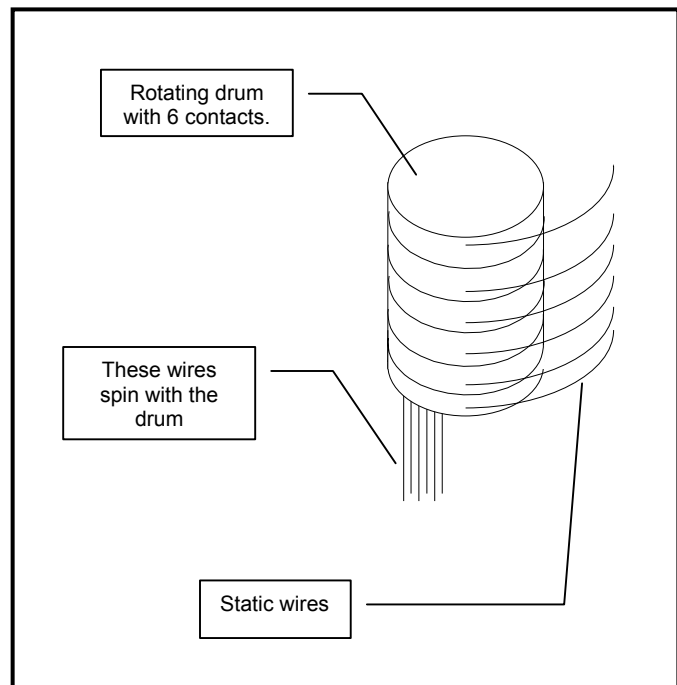
1.4.2 Discussion of Limit Stops in CCTV Systems

Many CCTV devices use limit stops. A limit stop is a mechanical or software device that ensures that the range of movement of a system stays within an acceptable range. Limit stops are commonly found on lenses and pan and tilt mechanisms.

Limit stops on lenses are present to limit the range of zoom, focus, and iris movement to what can be accommodated by the lens mechanics. The physical range of movement allowed for zoom movement, for example, is limited by the lens' track length.

Limit stops on pan and tilt devices can be either for limited mechanical motion (as in non-slip ring devices), legal reasons (you can't allow the camera to point toward the apartment complex), or for other practical reasons (no point in pointing the camera at the wall it's mounted on).

In non-slip ring pan and tilt mechanisms, the camera is connected to the outside world by a cable. This cable can only be twisted just so far before the cable will fail. It's common to have a "dead zone" or area the camera cannot see because of this limit. These limits, in most systems, can be moved so that the dead zone



can be placed where it will do no harm to the functionality of the system and are typically a few degrees wide.

Systems using slip rings, as shown in the illustration are capable of 360° movement without restriction. That is, these systems can spin in one direction without limit. A slip ring consists of a set of static wires that ride in a grooved drum. Each wire is bare on the end and makes electrical contact with the surface inside the groove in the rotating drum. The drum also has a set of wires that move with the rotating object (in CCTV this is the camera). Electronic messages, and voltage can then be applied, to a rotating assembly, without twisting wires. Occasionally, systems using slip rings will need to be used in places where limits must be applied. When they're applied, these units work like the non-slip ring units.

Many systems allow you to control the width of this dead zone along with its placement. With physical limit stops you would move a switch, or a block to the appropriate position and lock it in place. With software limit stops you aim the camera at one edge, then tell the system to remember this limit position.

The left limit stop is that stop that is reached when you pan to the left. That is, the image on the monitor indicates that the camera is turning to the operators left. This provides an unambiguous reference as to what is left, or right.

This standard provides a mechanism for setting pan, tilt, zoom, focus, and iris range limits.

1.4.3 Discussion of PositionReference Object

The PositionReference object is defined by a four (4) Byte OCTET STRING denoting those parameters that are required to control the detailed movement of the camera. Byte 1 of PositionReference defines the choice of mode for the following types of movement:

- stopMovement – bit value 00 meaning a cessation in camera movement.
- delta – bit value 01 meaning an incremental camera movement.
- absolute – bit value 10 meaning movement to an absolute position value, and
- continuous – bit value 11 meaning to start moving and continue until told to stop.

Byte 2 denotes the direction and speed of the movement, as follows:

- speed – signed INTEGER, with a range of -127 to +127, defining the speed and direction of movement.

It should be noted that the device is not required to support variable speeds. However, if variable speeds are supported, then the speeds of -1 and +1 are the slowest speed for a given direction of movement. Likewise, speeds of -127 and +127 are the fastest speeds for a given direction of movement. The value of 0 means a stoppage in movement. The direction of movement is denoted by the positive (+) and negative (-) portion of the signed values.

And, Bytes 3 and 4 denote the offset value, as follows:

- offset – two Byte INTEGER, with a range of 0 to 65535, defining the position or offset value.

Example 1 – Use of the stopMovement Mode of Movement

When the stopMovement choice is used, Byte 1 contains a bit mapped value of 00 indicating the choice of the stop movement command. Byte 2 has a value of 0, indicating a stoppage in movement. Bytes 3 and 4 are ignored for the stopMovement choice of movement modes.

Example 2 – Use of the delta Mode of Movement

When the delta choice is used, Byte 1 contains a bit mapped value of 01 indicating the mode choice of the delta movement command. Byte 2 is a signed INTEGER with a value between +1 and +127 or -1 and -127, with the value indicating the speed and the sign, positive (+) or negative (-), indicating the direction of movement. Bytes 3 and 4 are an INTEGER value between 0 and 65535 specifying the incremental

amount of movement. For those objects where the increment is given in $1/100^{\text{th}}$ degrees of movement, then the acceptable values for Bytes 3 and 4 are 0 to 35999. For those objects where the increment is given as a scalar value, then the acceptable values for Bytes 3 and 4 are 0 to 65535. For offsets yielding values beyond the limits, the device moves to the limit and stops.

*Example 3 – Use of the **absolute** Mode of Movement*

When the absolute mode choice is used, Byte 1 contains a bit mapped value of 10 indicating the mode choice of the absolute movement command. Byte 2 is a signed INTEGER with a value between +1 and +127 or -1 and -127, with the value indicating the speed and the sign, positive (+) or negative (-), indicating the direction of movement. However, the direction of movement is ignored for the absolute mode choice and the speed of movement is the value of the signed INTEGER. Bytes 3 and 4 are an INTEGER value between 0 and 65535 specifying the absolute value to which the device is to be moved, measured from the Home Position, with movement taking the shortest allowable path. For those objects where the absolute value of movement is given in $1/100^{\text{th}}$, then the acceptable values for Bytes 3 and 4 are 0 to 35999. For those objects where the absolute value of movement is given as a linear value, then the acceptable values for Bytes 3 and 4 are 0 to 65535.

*Example 4 – Use of the **continuous** Mode of Movement*

When the continuous mode is used, Byte 1 contains a bit mapped value of 11 indicating the mode choice of the continuous movement command, meaning to start moving and continue to move until another movement command is issued, or the device times out. Byte 2 is a signed INTEGER with a value between +1 and +127 or -1 and -127, with the value indicating the speed and the sign, positive (+) or negative (-), indicating the direction of movement. Bytes 3 and 4 are ignored for the continuous choice of movement modes.

1.4.4 Discussion of Zones

This standard allows for the establishment of user definable zones. A zone is a region in space that is defined by the pan and tilt limits of the device. As the device moves, zones may be encountered. Various actions may occur upon entering a zone. Such actions include displaying a label or turning off the video output. A defined zone where the associated action is to turn off the video output is sometimes referred to as a privacy zone by the user community. This standard allows for up to 255 zones to be defined.

It is expected that zones will not overlap. However, in the event that zones do overlap and labels are to be displayed while in the zone, at least one label will be displayed in the overlapped area.

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Section 2 GENERAL

2.1 SCOPE

The communications between an ITS Management Center or portable computer and ~~an~~ a Closed Circuit Television (CCTV) Camera Controller is accomplished by using the NTCIP Application Layer services to convey requests to access or modify values of CCTV Camera Control objects resident in the device via an NTCIP network. An NTCIP message consists of a specific Application Layer service and a set of data objects. An NTCIP message may be conveyed using any NTCIP defined class of service that has been specified to be compatible with the Simple Transportation Management Framework (STMF).

The scope of this document is limited to the functionality related to CCTV Camera Control within a transportation environment. This publication defines objects which are specific to CCTV and also defines standardized object Groups which can be used for conformance statements. The limits and descriptions of the parameters are established to give the user maximum flexibility to operate devices that either exist at the time this document was authored or may exist in the future.

2.2 REFERENCES

For approved revisions, contact:

NTCIP Coordinator
National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, VA 22209-3801

For proposed revisions which are under discussion by the relevant NTCIP Working Group, and revisions recommended by the Joint Committee on the NTCIP, browse to the Web at <http://www.ntcip.org>.

The following standards (normative references) contain provisions that, through reference in this text, constitute provisions of this Standard. Other documents and standards (other references) are referenced in these documents, which might provide a complete understanding of the entire protocol and the relations between all parts of the protocol. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of each standard listed below.

2.2.1 Normative References

NEMA	NTCIP 1201 <u>v01</u>	<i>National Transportation Communications for ITS Protocol – Global Object Definitions</i>
RFC1212	03/26/1991	<i>Concise MIB Definitions</i>
RFC1213	03/1991	<i>Management Information Base for Network Management of TCP/IP-based Internets: MIB-II.</i>
RFC1155	05/10/1990	<i>Structure and Identification of Management Information for TCP/IP-based Internets</i>

2.2.2 Other References

2.2.2.1 **NEMA Standards** Related

NEMA	NTCIP 1101	<i>National Transportation Communications and ITS Protocol – Simple</i>
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		<i>Transportation Management Framework</i>
NEMA	NTCIP 2001	<i>National Transportation Communications for ITS Protocol – Class B Profile</i>
ISO/IEC	8824-1995	<i>Information Technology - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1)</i>
ISO/IEC	8825-1995	<i>Information Technology - Open Systems Interconnection - Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)</i>
RFC1157	05/10/1990	<i>A Simple Network Management Protocol (SNMP).</i>

2.2.2.2 Texts

David Perkins and Evan McGinnis, *Understanding SNMP MIBs*, New Jersey, Prentice Hall PTR, 1997, ISBN 0-13-437708-7.

2.2.3 Contact Information

2.2.3.1 ISO/IEC Standards

Members of the ISO maintain registers of currently valid ISO/IEC International Standards. For the USA, the member of ISO is the American National Standards Institute (ANSI), which may be contacted as follows:

ANSI
11 West 42nd Street, 13th Floor
New York, New York 10036
(212) 642-4900

2.2.3.2 RFC Documents

Electronic copies of RFC documents may be obtained using “anonymous” FTP to the host nic.ddn.mil or ds.internic.net. Printed copies are available from:

DDN Network Information Center
14200 Park Meadow Drive
Suite 200
Chantilly, VA 22021
(800) 365-3642
(703) 802-4535

2.3 TERMS

For the purposes of this standard, the following terms and definitions apply. For terms not defined in this clause, English words are used in accordance with their definitions in the latest edition of *Webster's New Collegiate Dictionary*. Electrical and electronic terms not defined in this clause or in *Webster's New Collegiate Dictionary* are used in accordance with their definitions in IEEE Std 100-1992.

Absolute	A measure of pan, tilt, or zoom movement specified as the number of degrees relative to home position.
Alarm	An abnormal system condition that typically requires acknowledgement and correction by trained personnel.
Automatic Pan (Scan)	Continuous, automatic horizontal back and forth motion of a camera.
Auto Focus	The process of automatically adjusting the lens focus to provide a sharp image on the faceplate of the camera pickup device.

Auto Iris Lens	A lens where the aperture automatically opens or closes to maintain proper light levels on the faceplate of the camera pickup device.
Camera Power	The power supply delivered to the camera necessary for proper operation.
CCTV	Closed Circuit Television, any television system that transmits video information over a hardwire medium such as coax, fiber optic, twisted pair cable.
CCU	Camera Control Unit. A device used to multiplex and distribute multiple camera motion and lens position control inputs to multiple cameras. CCTV is also a distribution system that limits reception of an image to those receivers or monitors which are directly connected to the organization point by coaxial cable or microwave link.
Delta	A measurement in degrees of pan, tilt, zoom movement specified as the difference between an initial and final position.
Focus	The process of sharpening a blurred image on a screen, monitor, or any display; adjusting picture to achieve the greatest possible resolution.
Heater	A device used to maintain a constant camera enclosure temperature. A heater is typically thermostatically controlled and is used in harsh viewing environments.
Home Position	An arbitrary pan, tilt, and zoom position defined by the camera vendor. The home position represents a mechanical reference point from which camera and lens position parameters are measured.
Iris	A device used to control the amount of light that reaches the imaging sensor. The amount of light transmitted through a lens is controlled by an adjustable ~~diaphram~~ diaphragm , or iris, located in the lens barrel. The opening is referred to as the aperture, and the size of the aperture is controlled by rotating the aperture control ring on the lens barrel. The graduations on the lens barrel are expressed in terms of the focal length for the lens divided by the diameter of the aperture at that setting. This ratio is called the f-number.
Label	Text information embedded in the video and displayed on a monitor.
Lens	An assembly of optical components, usually made from glass, used to focus light on an imaging device.
Manual Focus	The process of manually adjusting the lens focus to provide a sharp image on the faceplate of the camera pickup device.
Manual Iris Lens	A lens in which the aperture is manually opened or closed to maintain proper light levels on the faceplate of the camera pickup device.
Octet Encoding Rules	A variation of Basic Encoding Rules (BER) developed for low bandwidth communications links.
Pan	Movement of the camera in a horizontal direction.
Preset	A pre-specified position where a camera is pointed to a fixed point in space. A preset includes pan, tilt, and zoom parameters. Presets are typically programmed by manually adjusting the camera position and lens zoom setting followed by initiating a save command from the