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# ST950 Plus<sup>+</sup>

3rd generation digitalised  
traffic control system

[siemens.co.uk/plusplus](https://www.siemens.co.uk/plusplus)

# ST950 Plus+

The Plus+ system distributes intelligence, particularly related to signal switching and monitoring around the intersection.

## The ST950 Plus+ system:

The ST950 Plus+ system is an advanced traffic control system using distributed intelligence with simple power and data cabling to increase intersection availability and reduce overall installation costs.

As a part of the successful ST950 family, the Plus+ system builds on more than 35 years of microprocessor-based traffic controller design and offers both familiarity and many exciting new user and maintenance features.

The system uses ELV (48VDC) supply voltages on-street, with inbuilt passive safety options and secure data communications, to provide the highest levels of safety and availability, whilst maintaining compatibility with many ST950 family components such as WiMag, Heimdall and other third party detector solutions.

With integrated UTM-based UTC SCOOT, Stratos Remote Monitoring and MOVA functionality and using a new dedicated range of street furniture and loop detector technology, the ST950 Plus+ offers great flexibility, providing Intersection, Puffin and Toucan methods of control.



## 3rd generation digitalised traffic control system

### System Overview:

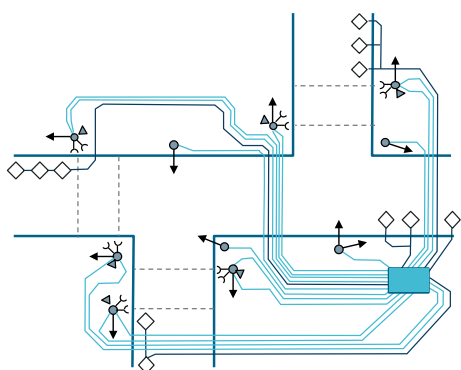
The Plus+ system distributes intelligence, particularly related to signal switching and monitoring, around the intersection using intelligent 'nodes' connected to the central controller via simple two pair cables.

Typically, the same cable type that would ordinarily be used for loop feeder applications can be used and the number of individual cables and cable cores required to service any given intersection is greatly reduced.

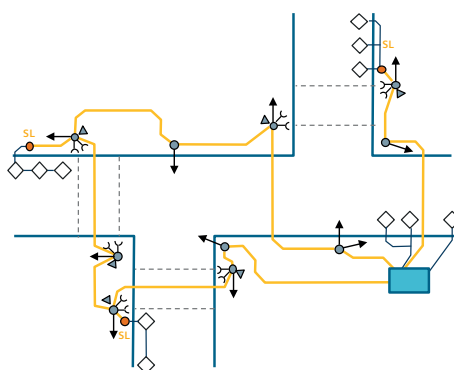
To offer the maximum flexibility and further minimise the number of cables required, the ST950 Plus+ controller supports several cable topologies, including rings, arms and spurs which can be used together depending on the physical layout of the intersection.

When the ring topology is used, the system is highly tolerant of cable breaks; even those caused for example, by the cable being cut during street-working accidents and typically will continue to function fully even after the cable cutting event.

### Plus+ cabling Diagram



Typical traditional cabling



Typical Plus+ cabling

To enable many signal and detector nodes to be connected to the same cable, the Plus+ system employs a range of dedicated node types.

**Helios Plus+ LED signals:**

Retaining all features of the standard Helios signals, (including outstanding phantom performance delivered by the use of the highly effective SIRA style lens), the Plus+ versions of the signals include a communication node to allow the signal to be directly connected to the Plus+ system cables. The internal RAG node electronics support up to four signal aspects as well as regulatory sign drives, so a single node is able to be used for a green arrow simultaneously with a full RAG signal and up to two regulatory signs. The node also provides a 24VDC supply and supports direct inputs for the connection of local above-ground detectors and where required a local 'solar cell' for signal dimming, eliminating the need for separate cable connections back to the host controller for these facilities.

**Helios Plus+ Nearside and Wait indicators:**

Manufactured in high precision die cast aluminium and of identical appearance to the standard Siemens pedestrian signals, the Plus+ range incorporates a series of nearside and wait-style signals, utilising both standard and narrow field of view optics. The nodes include drives for both audible and tactile indicators as well as push button inputs, also eliminating the need for separate cable connections back to the host controller for these facilities.

All units are fitted as standard with a robust mechanical switch, designed to give a long and reliable service life.

Where sites are particularly prone to vandal damage, all unit styles may be fitted with an advanced touch-sensitive button that has no moving parts. Based on the latest switch technology, this button is immune to the effects of rain and is fully operable, even by pedestrians wearing gloves.

**PCaTS:**

Support for standard ELV Helios PCaTS units is provided by a dedicated Plus+ interface card, which is fitted inside the PCaTS unit avoiding the need for special power cables to be run back to the ST950 Plus+ controller.

**Plus+ Smartloop:**

To prevent routing individual loop feeder cables to the controller cabinet, the Plus+ system supports a new Smartloop node. This provides 4 channel loop card functionality in a sealed unit which may be located very close to the loops and connected to the nearest Plus+ RAG node via a power and communications spur, using the same style two pair cable as other node connections. Configuration of the loop detector functionality is undertaken from the Plus+ controller, without the need to physically access the individual Smartloop nodes

The ST950 Plus+ controller also supports standard detector backplanes and loop detector cards, such as the Siemens SLD4, which are compliant with TR 2512 / TOPAS 2512.



The Plus+ system is fully compatible with Siemens UPS solutions ensuring that the operation of critical intersections is able to be maintained during times of mains power failure

# “Plus+ – Resilience by Design”

## Resilience by Design:

The Plus+ system has been designed from the ‘ground-up’ to deliver high reliability and great tolerance to individual node failure or cable damage caused by external events – Resilience by Design!

## Fault tolerant and secure communications:

System communication is provided using the well-proven RS485 standard, using dedicated protocols and SHA-256 authentication to ensure the highest possible data integrity is maintained, whilst avoiding the need for special cables - simple twisted pair loop feeder cables are typically able to be used for all on-street connections.

**Fail safe nodes:** All signal nodes incorporate dual safety processors and are fail-safe as independent devices, so that even under failure conditions they will not illuminate any signal colour unintentionally. This ensures that the system

does not need to absolutely rely on being able to communicate with modules at all times and allows them to be ‘hot-swapped’ in the event of failure, whilst the intersection remains powered and operational.

To further enhance safety, each individual LED aspect is tagged electronically to identify its actual colour. This ensures that only correct colour aspects are illuminated on-street, making it impossible for green and red signals, for example, to be swapped, by accident or maliciously, and then illuminated.

## Tolerance to broken / cut cables:

When connected using the ring topography, the Plus+ system provides a highly resilient solution which is able to tolerate a break in the ring, either caused by poor connection or due to a cable being cut, for example during streetworks. Robust design ensures that even short circuits which may occur during a cable-cutting event do not damage the system, which will restart automatically once the short circuit is removed.

## Redundant system power supplies:

The Plus+ on-street power is provided by one or more high-reliability 48V DC power supplies mounted in the controller cabinet. If required, these can be arranged as a redundant array, so that the failure of one of the supplies does not impact on the operation of the system. The failure is able to be reported, for example to Stratos, and the failed unit can be replaced whilst the system is fully operational, ensuring traffic control remains uninterrupted.

## Uninterruptable mains power supplies:

The Plus+ system is fully compatible with Siemens UPS solutions ensuring that the operation of critical intersections is able to be maintained during times of mains power failure.



ST950 Plus+ power supply

**Fully integrated MOVA 7 and UTMIC functionality:**

Using a powerful ARM microprocessor core, the ST950 Plus+ controller offers fully integrated UTMIC and MOVA functionality utilising advanced IP communications to the central office, without the need for additional outstation equipment. Up to 4 MOVA streams and up to 64 detectors per stream are supported.

Each stream is configured using the familiar MOVA set-up program and communication with MOVA is achieved via an IP link using MOVACOM. MOVA access is also available via the controller’s web browser interface which offers an integrated MOVACOM-like function, allowing access locally and remotely via non-PC devices, such as tablets or mobile phones.

MOVA data-sets are able to be changed either locally or remotely without impacting the running controller on-street. A dedicated MOVA mode is provided by the controller explicitly enabling MOVA control to be reported back to an associated Instation system, if required.

UTMIC OTU functionality is also supported using the same principles and offering a similar user experience to that provided by the Stratos Outstation, minimising user re-training.

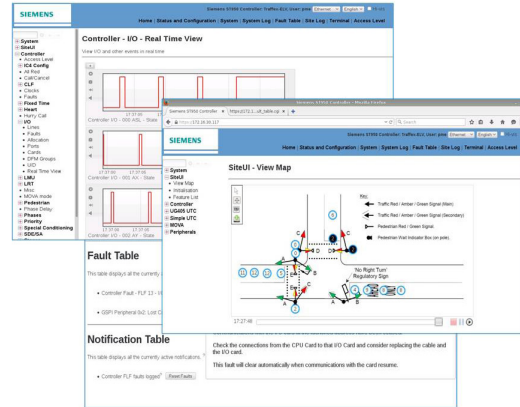
Stratos Remote Monitoring functionality is provided allowing detailed site fault reporting via the Stratos system. Remote Monitoring, UTC SCOOT and MOVA functionality are all able to be used together as dictated by traffic engineering needs.

The controller may be specified to include an additional 2U equipment rack, which neatly houses the chosen IP communication router or modem, providing for example, ADSL, Fibre or 3G / 4G communications to the Stratos system.

**Integrated passive safety:**

Where passively safe poles are required, the Plus+ system delivers extensive inbuilt functionality.

Passive poles may be connected individually to the Plus+ controller or arranged in groups as determined by the layout of the site. Impact sensors are built into each RAG, nearside and wait indicator node and if triggered will signal to the controller that power to the pole or pole group is to be removed. Power removal is achieved within 400ms of the pole strike being detected and will be reported as a fault which may be forwarded to Stratos, if required.



Testing of the whole passively safe system may be undertaken using the ST950 Plus+ web browser user interface, which allows individual pole strikes to be simulated to ensure that all the correct actions are properly configured.

The inbuilt passive functionality is achieved without the need for separate pole strike sensors, extra cabling or the extra cabinet mounted equipment usually associated with passively safe sites.

**Enhanced I/O capability:**

The ST950 Plus+ controller is able to support up to 248 I/O lines allowing up to a maximum of 240 digital inputs or up to 96 isolated digital outputs to be provided, depending on the controller configuration. Inputs and outputs may be provided centrally at the controller using ST950 I/O cards or distributed around the intersection in individual nodes.

In many cases, the use of traditional I/O cards inside the controller cabinet is unnecessary as equipment such as above ground detectors and push buttons are connected directly to the nearest node on-street. However, where controller I/O is required this is provided by standard ST950 I/O cards, which are designed as ‘intelligent terminal blocks’ and are located directly where needed within the controller cabinet to optimise street wiring.

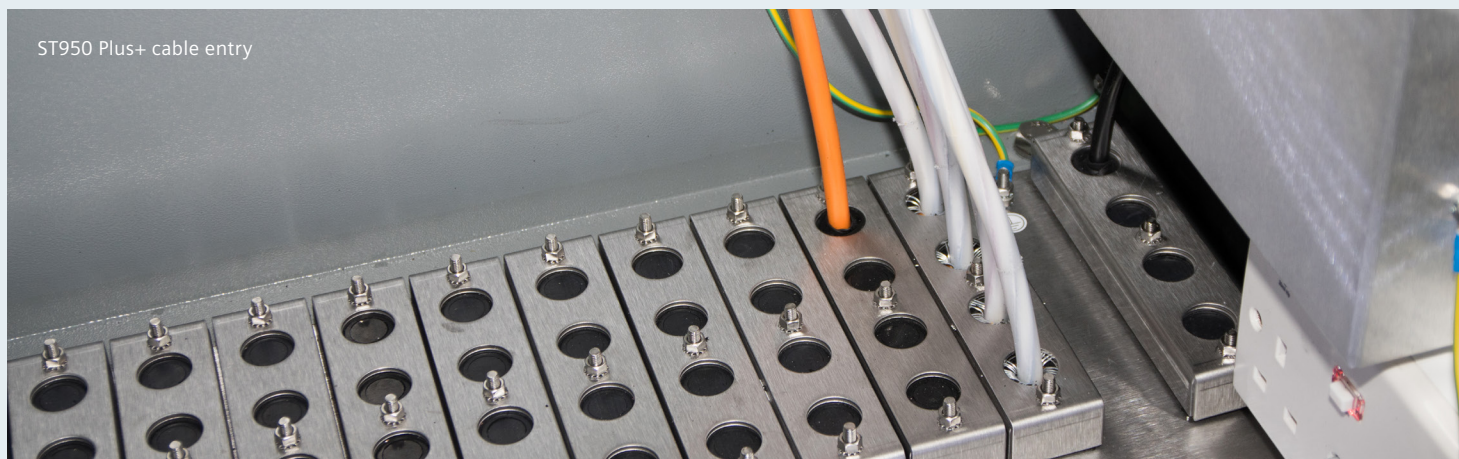
Similarly, where loop detector cards are required to be fitted in the controller cabinet, the ST950 Plus+ controller supports the standard ST950 intelligent detector backplanes.

The ST950 Plus+ also fully supports the WiMag (magnetometer) loop detector replacement card as well as the Wimag I/O card, which when fitted in the corresponding rack, allows up to 60 magnetometers to be efficiently interfaced directly to the controller without the need to use detector backplanes.

**Simplified installation and maintenance:**

The ST950 Plus+ controller retains the modular nature of other family members and allows internal equipment, such as power supplies, I/O cards and Plus+ controller interface cards to be specified as required, optimising the equipment for the site on which it is to be used.





ST950 Plus+ cable entry

### Efficient cabinet base options:

The Plus+ system introduces a new controller base which is designed to raise the controller, making it easier to install and maintain as well as providing an innovative solution to cable entry into the cabinet. If necessary, the controller base can be installed without the full cabinet, to allow street construction and cabling to take place and the cabinet, with its internal components, then added to the base prior to commissioning.

The controller cabinet design also supports the latest NAL bases, providing easy connection to integrated duct works where this is required.

### Advanced diagnostics:

The controller web browser interface provides access to extensive fault and performance data related to the operation of the Plus+ network on-street and all of the connected intelligent devices linked to the network. In the unlikely event of faults occurring on-street, these are usually able to be reported down to the actual pole location – for example Red Lamp Fail: Phase A, Pole 12, reducing overall fault diagnostic and maintenance time.

In common with other ST950 family members, the controller is able to provide audible feedback in the form of spoken phrases to an engineer on-site utilising their mobile phone or other device via a plug-in Bluetooth dongle. For example, an engineer may select a detector input to monitor and move to the location of that detector. The controller will “talk” to the engineer via the Bluetooth link informing them when the loop input is active. This enables them to focus on observing vehicles moving over the loop rather than trying to visualise both activities on the street and data being displayed on a terminal device.

In addition, many changing controller parameters may be displayed visually, as a time-based graph, aiding the engineer when diagnosing intermittent or infrequent events.

An extensive inbuilt self-test facility, which validates both the controller hardware and the intelligent street equipment, provides a further invaluable aid to controller commissioning.

The ST950 Plus+ is also able to provide a full statement of timing and other data such as detailed hardware information about all intelligent PCBs fitted in the controller and all on-street devices connected to the Plus+ network. The data is formatted to be used as part of an annual Periodic Inspection report and is able to be simply exported from the controller to a PC, from a web page locally or remotely. Alternatively, it can be exported directly to a USB memory stick on-site using simple handset commands.

### Reliable feature-rich software:

The ST950 plus+ controller offers the same highly reliable and proven features as other ST950 family members, including:-

- 32 phases, 32 stages
- 8 streams
- 8 maximum green sets
- 8 hurry calls which are in priority order
- 8 uni-directional detector loop units
- Multi-mode operation with stage ripple change facility for improved intersection capacity
- Separate MOVA and UTC operating modes
- Fully integrated Light Rapid Transport (LRT) mode for use at Tram / Road intersections
- Fully configurable lamp sequences for worldwide application
- Fully integral and configurable lamp monitoring features
- Flexible part-time and start-up modes, allowing any stream to be sent in and out of part-time mode without affecting any others
- Cableless linking (Plan) facility with sophisticated plan timetables and supporting 16 plans and 32 groups per plan
- Event timetable which supports actions based on 32 independent events with easy programming
- Time system with full date details – automatically time synchronised to NTP or central system time where the controller is linked to Siemens UTM central system
- Date stamped rolling log providing detailed history of events and faults, coupled with improved presentation to aid recognition of entries
- Uncomplicated web browser user interface capable of multi-language support
- Configurable system dimming levels

**Full design and configuration suite:**

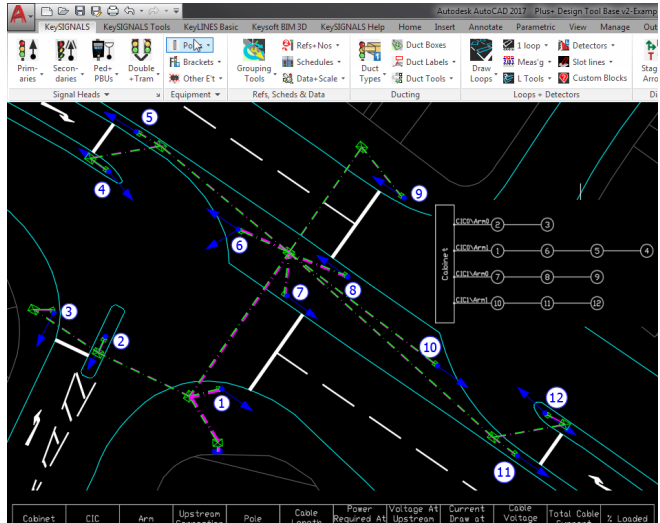
The ST950 Plus+ system is highly user configurable and may be programmed to meet almost any traffic control demands.

**Intersection Design tool:**

The Plus+ System supports a ring, star and spur topology but deciding which is most suitable can be complex with intricate electrical calculations required. The Plus+ Design Tool is a key aid to simplify the necessary design tasks, allowing traffic signal design engineers and approving authorities to easily determine the most suitable and economic Plus+ cable structure throughout an intersection.

Working with the industry leading traffic signal design software provider KeySoft Solutions, the design tool is an AutoCAD plugin which works with the latest version of AutoCAD and KeySignals.

The designer completes the traffic signal design in the normal way, positioning all traffic signal poles, equipment and ducting. Using these positions, the designer then selects the desired cable routes. The Plus+ Design Tool links the KeySignals objects to an equipment library containing all the information needed to complete the electrical calculations. It uses the ducting and pole positions to map the cable route and automatically draws a cable diagram with visual indicators that show the electrical capacity of a cable. The designer is then able to make informed decisions about the most economical cable topology for the intersection, but most importantly, can have complete confidence that the topology chosen will work successfully on-site.

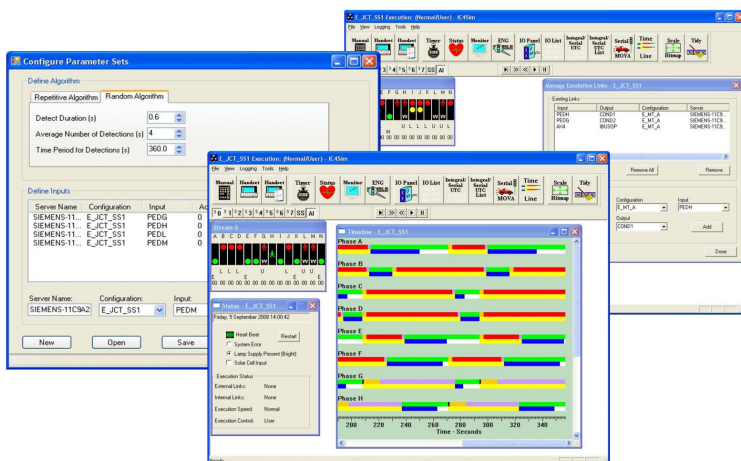


Plus+ Design Tool

**Configuration:**

The IC4 configurator is an easy to use tool for generating configuration data sets for the complete family of Siemens controllers, including the ST700, ST750, ST800, ST900 and the ST950. Most data is simply entered via a series of 'forms' and is validated for correctness as part of a sophisticated error checking process. Enhanced navigation aids and selectable levels of configuration complexity, insulate the user from controller facilities that are not being used, simplifying the configuration process.

An extensive traffic conditioning language is also supported, enabling complex special conditions and actions, over and above those offered directly within the controllers operating firmware, to be efficiently programmed.



**Features:**

- Fully integrated UTMCO OTU and MOVA 7 functionality
- Fully integrated Stratos Remote Monitoring
- Built-in passively safe switch off features
- Easy-to-use web-based user interface
- Full tool set and integration with Key Signals site design tool
- Inbuilt live graphical site map
- Unique audible feedback of controller





The configuration data created by IC4 may be loaded into the controller using several different methods:

- On-Street - directly from a PC via the USB handset interface
- On-Street - directly from an appropriately configured USB memory stick
- Remotely - by downloading the configuration from a central office, depending on national regulations. The new configuration can either be enabled remotely or be held waiting for an engineer to activate it on-street

Subject to safety constraints, most configuration data, including UTMC OTU and MOVA datasets may be loaded into the controller and activated whilst the signals remain illuminated, ensuring minimum disruption to traffic whilst a configuration update is undertaken.

The configuration data as well as controller fault and operation logs and many other controller operating parameters are stored on a removable SD card held on the main controller CPU card. In the unlikely event of a CPU card failure, this card may be removed and installed into the replacement CPU, returning the controller to operation exactly replicating the original.

The card may also contain other data such as site drawings, log book information, controller handbooks and other site notes that may be of help to a maintenance engineer on-site.

## Operation to ease on-street maintenance activities:

- Multi-language capability
- Local and remote user access with optional PKI security and user action logging
- Up to 32 phases, 32 stages and 8 independent streams
- Up to 240 digital inputs/output lines
- Integral lamp monitoring of all phases and signal colours

Configuration data can be retrieved via the USB web interface and easily imported back into IC4 for re-editing. Existing data from T200, T400, ST800 and ST900 controllers can be imported as the basis of new ST950 family configurations, significantly easing controller upgrades.

### Emulation:

The optional controller emulator links seamlessly with IC4 to provide an advanced environment for de-bugging and proving ST700, ST800, ST900 and ST950 controller family configurations. It ensures an accurate representation of the controller's operation on a PC, using the same software source files as the appropriate controller firmware.

# Technical Specification

## Approvals and specifications:

- Compliant with TOPAS TR2500 and TOPAS TR2513
- Compliant with relevant sections of TOPAS 2523
- CE Approved
- RoHS Compliant

## Inbuilt modes of operation:

- Manual
- Fixed-Time
- Vehicle Actuated
- Urban Traffic Control
- MOVA (Implements MOVA 7)
- LRT
- Pedestrian Fixed Vehicle Period
- Pedestrian Vehicle Actuated
- Part-Time
- Cableless Linking
- Hurry Call
- Emergency Priority

## Phases and stages:

- Number of hardware phases: 1-32 (Phase sequences programmable)
- Number of independent streams: 8
- Number of stages: 32
- Number of switched signs: 0-32
- Number of max. green periods per phase: 8
- Number of phase delays: 120
- Number of call and cancel timers: 8
- Number of stage-based all red extension units: 7
- Number of phase-based intergreen delays: 64
- Number of hurry calls: 8
- Number of emergency/priority units: 8

## High-speed vehicle detection:

Integral speed discrimination, double/triple speed assessment

- Number of assessors: 16

## Cableless linking facilities:

- Number of plans: 16

- Number of groups per plan: 32
- Number of time switch settings: 64
- Number of group influences: 10
- Timing sources 50/60Hz mains, Internal Crystal, NTP network time server or optional GPS clock

## Inputs and outputs:

- Number of digital inputs: 0-240, compliant to TOPAS 2523
- Number of isolated digital outputs: 0-96 compliant to TOPAS 2523

(Actual maximum number of inputs and outputs achievable depends on configuration and distribution in nodes around intersection - up to a maximum of 248 in total).

## Other facilities:

- Fully integrated MOVA 7 (licensed by Smart Card)
- UTMCO SCOOT UTC and Stratos Remote Monitoring functionality (Licensed by Smart Card)
- Inbuilt passive safety facilities (Licensed by Smart Card)
- Standby mode:
  - Signals off
  - Software flash
- Failure modes:
  - Signals off
  - Software flash per-stream
- Flash type – selectable:
  - Flash red or yellow per phase
  - Mark/space and flash rate selectable for whole controller
- Programmable signal dimming: 10% to 30% of full intensity (one setting for whole controller)
- Web based user interface with audible feed for maintenance activities
- High-speed serial handset port 1200, 9600 and 19200 baud. Port is auto bauding.

## Controller cabinet:

- Height: 1460mm (above ground level with 'zero harm' stool)
- Width: 725mm
- Depth: 420mm

## Environmental:

Designed to meet:

- EN12675
- EN 50278
- Operating ambient temperature range: -25°C to +70°C

## Electrical:

- Input power supply (+20, -15%): 100V, 110V, 220V, 230V AC RMS
- Supply frequency: 50/60Hz ±4%
- Supply interruption: Continuous operation up to 50ms break (nominal mains supply)
- Supply failure: Automatic restart without operator intervention
- On-Street Plus+ supply 48V DC
- Maximum street load: 300W to 1200W (With power supply redundancy)
- Maximum cable distance from controller to furthest node: 350M

## On-street Plus+ supply:

- 48V DC
- Maximum street load:
  - 300W to 1200W (With power supply redundancy)
- Maximum cable distance from controller to furthest node: 350m

## System capability:

- Number of CIC cards per cabinet: 3
- Number of system cabinets: 2
- Number of cable rings per CIC: 3
- Number of independently switchable arms per CIC (for passive safety): 12
- Typical number of signal nodes per arm or ring: 18 (dependent on distance from the controller)

**Helios Plus\* signal heads:**

## Optical Performance:

- Certified to EN12368, performance class 3/2
- Phantom ratio: Class 5 (better than 16:1)
- Output intensity: Type M class A (400 cd)
- Optic sizes:
  - Standard optic: 200mm with SIRA lens
  - Regulatory sign: 300mm
- Modular construction options
- Single, two, three and four aspect assemblies
- Flexible options for side boxes and other requirements
- Will accommodate a wide range of louvered hoods
- Backing boards available for all construction options
- Retro-reflective edging
- Anti-vandal lens screen

## Overall power consumption (3 aspect signal)

- Bright: 12W
- Dim: 5W

**Helios Plus\* nearside signals:**

## Overall optical performance:

- Compliant with TOPAS 2511

## Construction (all types)

- Casting: Precision cast aluminium alloy
- Signal Screen: UV resistant polycarbonate

## Environmental (all types)

- Operating temperature: -15°C to +60°C
- Water penetration: IPX5

## Optical performance (all types):

- Red symbol (typical): 29cd
- Green symbol (typical): 34cd
- Viewing angle (NFV version): +/-25° (approx)
- Demand accept LED ring: 24cd

## Typical power consumption (excluding tactile unit)

- Red symbol: 16W
- Green Symbol: 16W
- Demand Ring: 5W

## Dimensions

Two part nearside display unit: 360mm (H) x 225mm (W) x 130mm (D)

- Weight: 4.8Kg

## Two part nearside demand:

- 180mm (H) x 225mm (W) x 130mm (D)
- Weight: 3.2Kg

## Single part nearside demand &amp; display unit:

- 448mm (H) x 225mm (W) x 133mm (D)
- Weight: 6.5Kg

**Plus\* Smartloop:**

## Approvals and specifications

- Compliant with TOPAS TR2512
- Radio approvals to ESTI 300-330
- CE marked

## Loop parameters

- Loop operating frequency: 30-120 KHz
- Loop inductance: 20-2000 microhenries including feeder cable
- Loop feeder length: 300m min
- Recommended loop cable: 1.5 or 2.5sq.mm
- Sensitivity: Set in defined steps from controller interface from 0.01% to 1% dL/L.
- Presence time • Four preset presence time selections between 3.5 seconds and 2 hours. Set from controller interface.

## Environmental

- Operating temperature: -25°C to +80°C



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Traffic Systems**

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