



LCAM – Luminance Photometer

Installation Manuel V1.9



● ● ● Intelligent Tunnel Lighting Control



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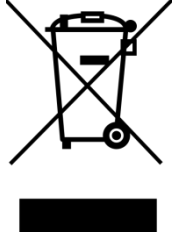


Glossary

ESD	Electrostatic discharge
LCAM	Luminance Photometer
RFI	Radio Frequency Interference

Warnings

Throughout the manual the following symbols are used to highlight the potential dangers when installing, operating and servicing the instruments.

	Caution; Care must be taken, refer to specific instructions.
	Warning; Risk of electric shock.
	Protective Conductor Terminal.
	Recycle Responsibly.
	Attention; observe precautions for handling electrostatic sensitive devices.
Note:	Highlights a specific instruction or operating procedure.

General Warnings

Each section of the manual outlines the specific warnings for that part of the process or procedure. Below are some general guidelines that should be followed at all times:

- *The instrument is particularly vulnerable during transportation and manual handling. Always transport the instrument in its original packaging and handle with utmost care.*
- *Prior to use, the equipment should be stored in its original packaging in a dry and sheltered area.*
- *Applications vary and all installations will involve a degree of application engineering which is the responsibility of the customer, not Nyx Hemera Technologies.*
- *All installations and connections must be made by suitably qualified and experienced electrical / mechanical engineers with proper regard to good practice and compliance with applicable legislation.*
- *The instrument contains sensitive optics and electronics and must be protected from physical shock, vibration and exposure to moisture at all times. Always handle with care, replace lids and covers when not in use and protect from water ingress.*
- *The instrument contains sensitive electronics which are vulnerable to ESD and therefore care should be taken to avoid making contact with electronic circuit boards & components. Use ESD handling precautions.*
- *All electrical work must be carried out with the power to the instrument OFF i.e. it must be isolated from any source of voltage. Failure to do so could result in equipment failure, injury or death.*
- *Do not make or break electrical connections whilst power is connected to any instrument. "Hot plugging" as this is known, may damage the electronics and require a circuit board to be replaced. This is NOT covered under warranty.*
- *Always calculate potential voltage drop when specifying the type / length of connecting cables, taking care to allow for the output tolerance of any power supply. The supply voltages indicated in this manual are those required at the point of connection to the instrument.*
- *The cables to and from the instrument carry sensitive electronic signals which can be affected by RFI and EMI, so care should be taken to run the cables away from high voltage power cables, high frequency signal cables, or switch gear cabling. Ideally any cables*

connecting to the instrument, or between instrument components, will follow an independent route and will not be installed in bundles or cable trays with other cabling.

- ***The ferrite tubes supplied must be fitted on all cables that enter / exit the instrument. They should be located outside the enclosure, but immediately adjacent to the cable entry glands.***
- ***The instrument must be properly bonded to a local protective earth. Protective earthing is essential, not just as a safety precaution, but also to maintain the instruments compliance with European safety directives, CE, CSA and UL marking.***
- ***A warranty certificate is provided with each order. Failure to follow the procedures outlined in this manual, unless specifically instructed to do otherwise, could invalidate the warranty.***
- ***Read the manual in full before proceeding. If in doubt contact Nyx Hemera Technologies.***
- ***This equipment must not be used any way that not described in this manual.***

Product Overview

The Luminance Photometer (LCAM) measures the level of luminance, or brightness, created by natural light at the tunnel entrance / exit to ensure that the visual perception of drivers will be maintained, both day and night, by avoiding sudden variations in lighting levels and potential “black hole effect” when entering and exiting a tunnel.

The LCAM uses a specially designed, highly light-sensitive photocell, filtered to provide a spectral response close to the average human eye, to react to changes in light levels at the entrance and exit, as well as within, the tunnel environment. This reaction is virtually instantaneous.

The light receptor measures the average luminance within a fixed viewing angle that can be pre-set to be anywhere within the range 10 to 40°. The standard instrument has a viewing angle of 20°, (L20, as recommended by International Commission on Illuminance, (C.I.E.), publication 88, 2004). The luminance measurement range is 0 to 10,000 cd/m², which can be scaled to suit customer requirements.

The LCAM is a self-contained intelligent analyser and the measurements are converted into an output signal of 0/2/4-20mA (directly proportional to the luminance measurement) for hard wire connection and signal transmission to a host controller. The LCAM has alarm relay contacts and supports Modbus serial communications protocol.

The LCAM has been designed to enable it to withstand extremes of weather conditions. The complete electronic system is contained within a water-proof, heated housing of powder coated stainless steel with an IP66 protection rating.

The LCAM has an operating temperature range from -40°C to +50°C which ensures stable readings across all prevailing ambient temperature conditions.

Various optional extras are available such as, mounting brackets and wash-wipe systems, providing a solution for the most demanding specifications.

Rating

Voltage: 100-240Vac

Frequency: 50/60Hz

Current: 1.5A

Environmental: IP66

Fuse

The fuse on the main terminal board must only ever be replaced with a fuse of the following specification: 5A, 250Vac, Fast Acting, Ceramic.

Physical Installation



Caution; care must
be taken

All installations and connections must be made by suitably qualified and experienced electrical / mechanical technicians with proper regard to good practice and compliance with applicable legislation.



Caution; care must
be taken

The instrument contains sensitive optics and electronics and must be protected from physical shock, vibration and exposure to moisture at all times. Always handle with care, replace lids and covers when not in use and protect from water ingress.



The instrument contains sensitive electronics which are vulnerable to ESD and therefore care should be taken to avoid making contact with electronic circuit boards & components. Use ESD handling precautions.

Choosing a location

When national and international standards, such as CIE publication 88 or ANSI/IES RP-22, are applied for the tunnel design, the location of the tunnel entrance photometer is likely to be pre-defined by the final design specification of the tunnel.

In the event that the location is not defined by the tunnel design specification, it is recommended that the applicable official standards are followed.

At the time of writing, these recommendations include:

- Mount a 20° viewing angle monitor (L20) at the driver's safe stopping distance from the tunnel portal, based on the maximum approach speed allowed for in design, and national definitions of "safe stopping distance".

Note: *If it is not possible to fix the monitor at the recommended distance from the portal then a monitor with a different viewing angle could be used. The required viewing angle will scale with the inverse of the distance from the portal.*

- Mount the monitor at a height of 3-5m, on a pole, or gantry, above the carriageway
- Orientate the monitor in both horizontal and vertical planes such that it looks directly at the tunnel portal, centring on a point ~1.5m above the surface of the carriageway.

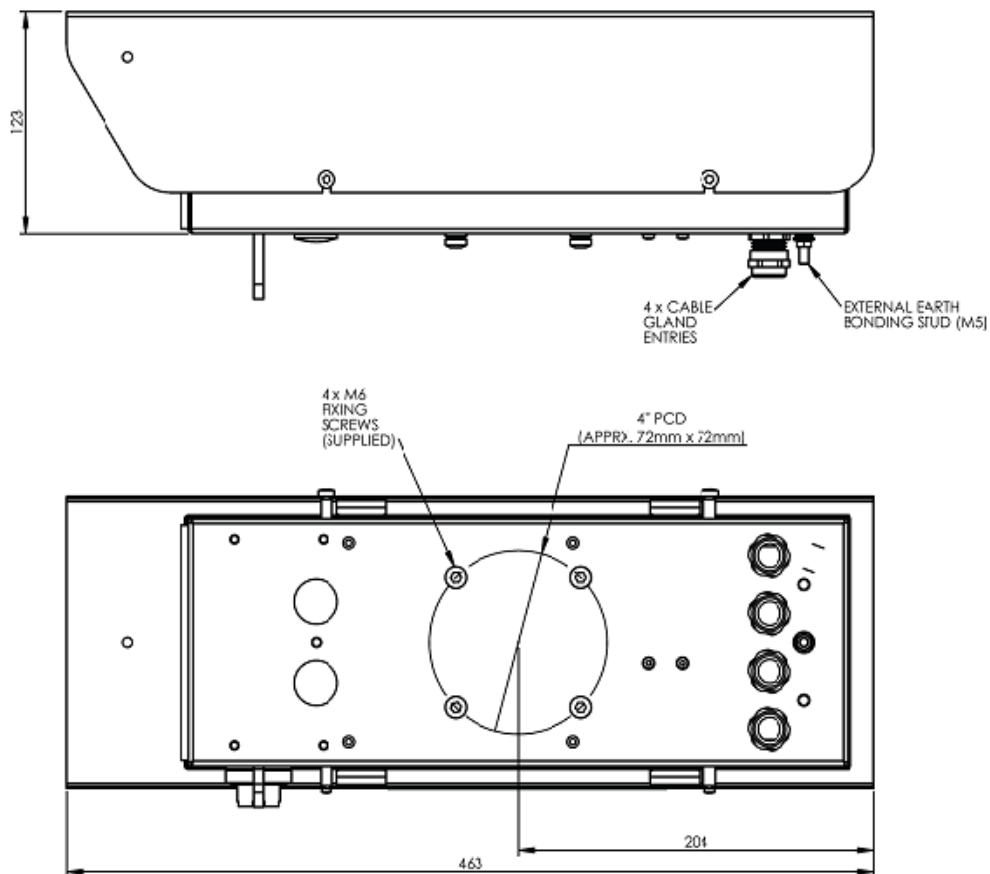
In order to comply with safety standards the LCAM must not be installed at altitudes >2000m.

Fixing details

The LCAM can be attached to either a wall mounting bracket (suitable for gantries), or a pole/post top mounting bracket; both of which are available separately from Nyx Hemera Technologies (see Appendix A). Both bracket styles allow for lockable pan/tilt adjustment.

The LCAM is fixed to either bracket, using the four (4) screws supplied in the base of the LCAM enclosure. It is essential that all the screws and washers are fitted and that they are all fastened securely prior to operation.

See the diagram below for overall dimensions and fixing screw positions.



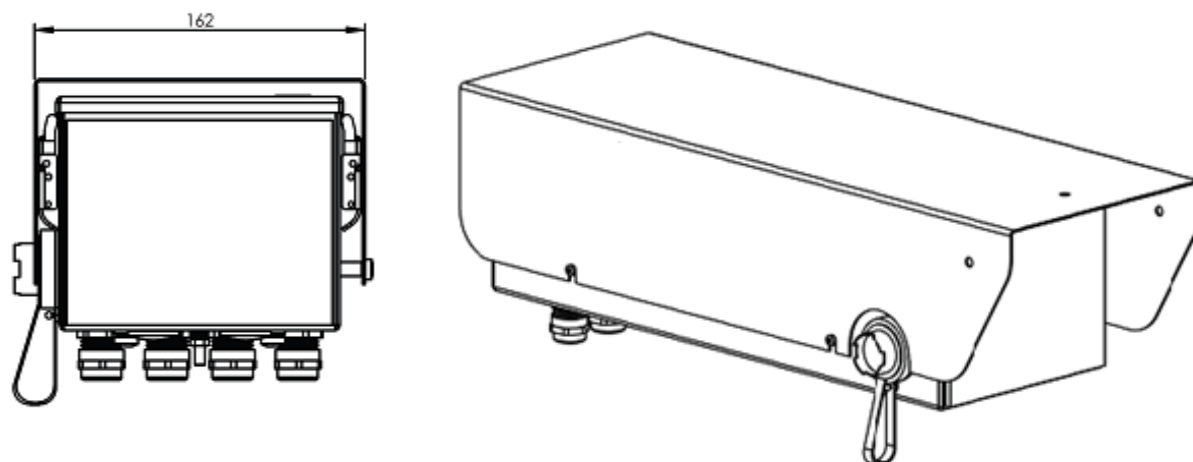


Figure 1 – LCAM overall dimensions and fixing screw positions



Alignment

When the LCAM is mounted in position, it should be angled (using the pan/tilt arrangement) in both horizontal and vertical planes such that it points directly at the tunnel portal, centring on a point ~1.5m above the surface of the carriageway.



A line of sight taken through the gap between the top of the enclosure and the inside of the sunshield should be sufficiently accurate to achieve alignment in the vertical; whilst the same technique between the side of the enclosure and the sunshield will achieve the horizontal alignment.

All nuts/bolts (including those of the pan/tilt assembly) must be fastened securely prior to operation.

Electrical Installation

All electrical work must be carried out with the power to the instrument OFF i.e. it must be isolated from any source of voltage. Failure to do so could result in equipment failure, injury or death.



All installations and connections must be made by suitably qualified and experienced electrical / mechanical engineers with proper regard to good practice and compliance with applicable legislation.

The instrument contains sensitive transducers and electronics and must be protected from physical shock, vibration and exposure to moisture at all times. Always handle with care, replace lids and covers when not in use and protect from water ingress



The instrument contains sensitive electronics which are vulnerable to ESD and therefore care should be taken to avoid making contact with electronic circuit boards & components. Use ESD handling precautions.



Do not make or break electrical connections whilst power is connected to any instrument. "Hot plugging" as this is known, may damage the electronics and require a circuit board to be replaced. This is NOT covered under warranty.



Always calculate the potential voltage drop when specifying the type / length of cables, taking care to allow for the output tolerance of the power supply. The stated voltage supply is that at the point of connection at the instrument.



The cables to and from the instrument carry sensitive electronic signals which can be affected by RFI and EMI, so care should be taken to run the cables away from high voltage power cables, high frequency signal cables, or switch gear cabling. Ideally any cables connecting to the instrument, or between instrument components, will follow an independent route and will not be installed in bundles or cable trays with other cabling.



The ferrite tubes supplied must be fitted on all cables that enter / exit the instrument. They should be located outside the enclosure, but immediately adjacent to the cable entry glands.

The instrument must be properly bonded to a local protective earth. Protective earthing is essential, not just as a safety precaution, but also to maintain the instruments compliance with European safety directives, CE, CSA or UL marking.

Protective earth bonding requirement

An independent protective earth conductor must be connected between the earth bonding stud (M5) on the underside of the enclosure (see illustration below) and a verified electrical earth potential.

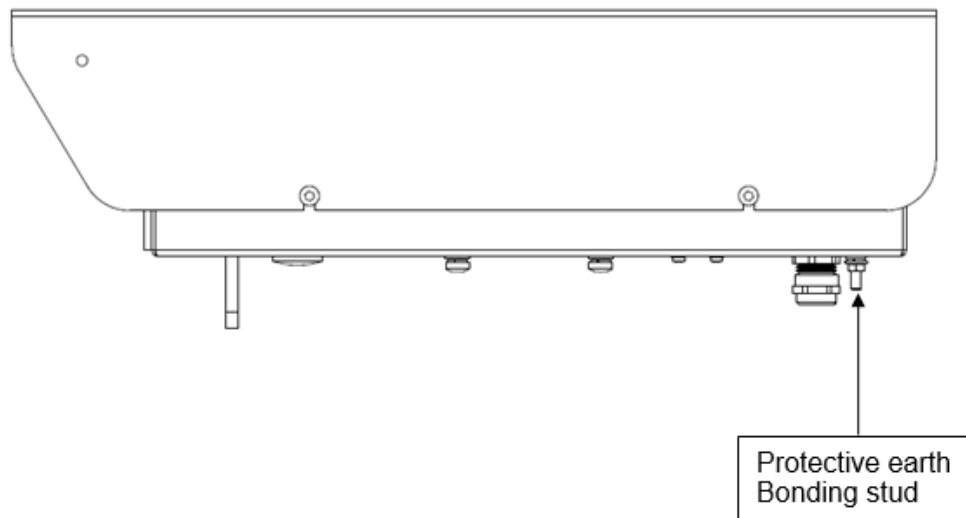


Figure 2 - Protective earth bonding stud location

Cable specification

The standard LCAM is a single component instrument, with no requirement for interconnection between components, and therefore no cables are supplied with the instrument.

The specification of cables and wires necessary to connect power and other interface connections to the LCAM is therefore a matter for the customer. However, all cables should have an individual core size of between 0.518mm² (20AWG) and 2.08mm² (14AWG), as this is the acceptable range for the terminals employed on the circuit boards inside the LCAM.

All cables and wires must be suitable for their load.

All cables must have an external diameter in the range 6-12mm, as this is the acceptable range for the cable glands employed in the instrument. The use of cable <6mm diameter will prevent the cable gland

from providing sufficient anchorage to the cable and may also allow water ingress. Both eventualities would result in an unsafe installation.

It is recommended that for Modbus (RS485) and analogue output wiring, individually screened twisted pair cable, such as Belden 9873 (6 core, screened pair, 20AWG), is used.

The illustration below highlights the key criteria for cable specification

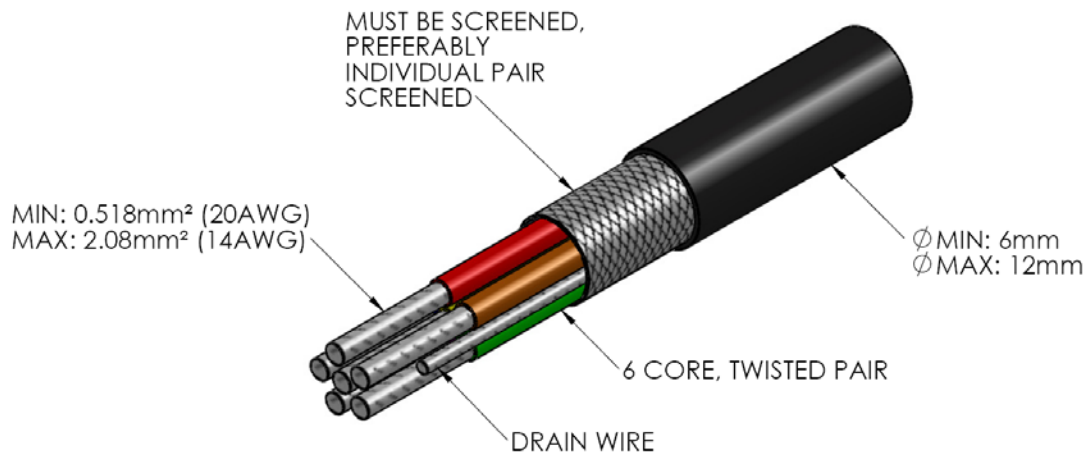


Figure 3 – RS485 cable specification

Cable glands and ferrite tubes

All connecting cables must enter the instrument enclosure by passing through the cable glands provided. Once the cables have been passed through the cable glands, all cable glands must be tightened sufficiently to achieve a water tight seal and provide mechanical anchorage of the cables.

Note: The use of cable <6mm diameter will prevent the cable gland from providing sufficient anchorage to the cable and may also allow water ingress. Both eventualities would result in an unsafe installation. Therefore all cables must be >6mm diameter.

Any unused cable gland entries must be sealed by inserting the rubber sealing bungs provided and tightening the cable gland onto the bung to achieve a water tight seal.

The ferrite tubes supplied must be fitted to all cables that enter the instrument enclosure. The tubes must be fitted externally, but immediately adjacent to the cable gland. The illustration below demonstrates the preferred method for securing the ferrite tubes in place.

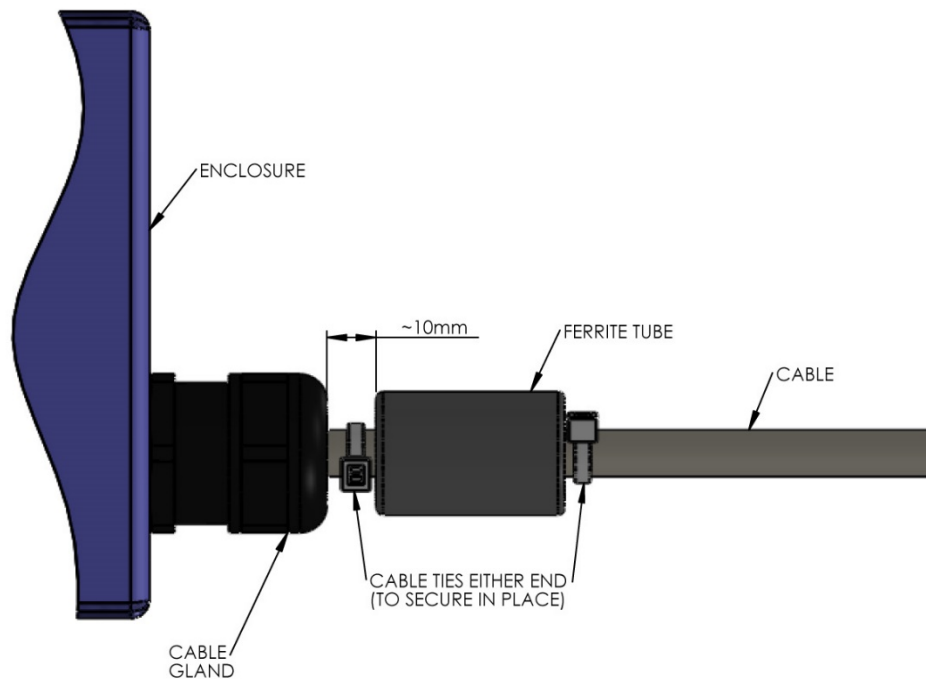


Figure 4 - Cable glands specification

Connectors overview

The illustration below gives an overview of the connections available inside the LCAM. See also drawing set LCAM-D03-10000 for more details.

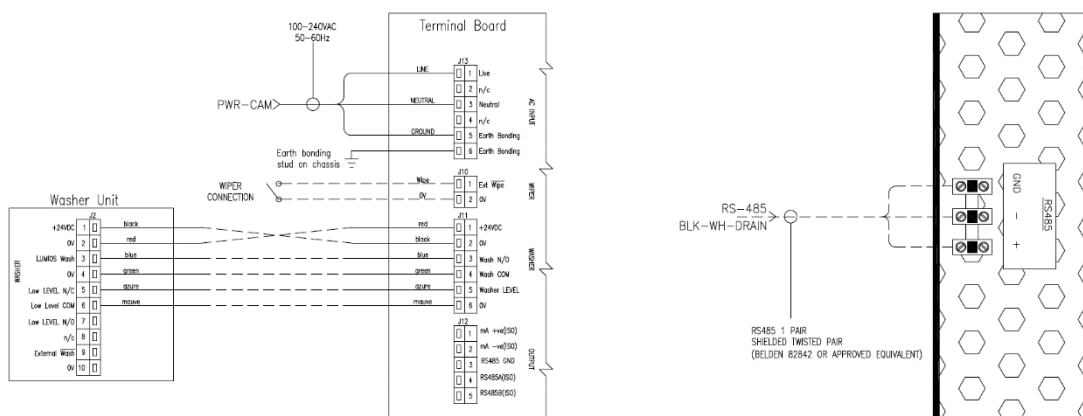


Figure 5 – Connectors overview

Installation wiring

Notes on AC power supply connection

The voltage requirement for the AC supply is 100-240VAC 50/60Hz. The incoming AC power supply must include an earth connection.

The fuse on the main terminal board must only ever be replaced with a fuse of the following spec: 5A, 250Vac, Fast Acting, Ceramic.

The AC supply to the equipment must employ a circuit-breaker for over-current protection and as a means of disconnection. The circuit breaker must meet the following conditions:

- It must be rated for 5A over-current protection.
- It must be suitably located and easily reached, e.g. in a switch room.
- It must be clearly marked as the disconnecting device for the LCAM.

Notes on isolated analogue output connection

The isolated current loop analogue output must only be connected to a passive input. Connection to a powered input will damage components on the LCAM circuit boards. Individually screened twisted pair cable is recommended for this connection. 0-20mA, 2-20mA or 4-20mA operation is a software option and can be set via the Utility Software.

Notes on Modbus (isolated RS485) serial communication connection

The RS485 connection can be configured to operate using either DSL or Modbus protocol, as required. See the User Manual for details of switching between the two. Individual screened twisted pair cable is recommended for this connection.

A “LAST HEAD” link can be found on the right hand side of the CPU board inside the LCAM; as indicated below.

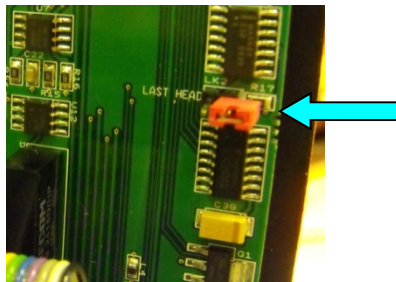


Figure 6 – LAST HEAD’s location on CPU board

When fitted, this link introduces a 120R termination resistor across the two RS485 conductors (RS485A/B).

Where the LCAM is used in a one-to-one configuration i.e. one (1) Modbus master device communicating with just one (1) LCAM, this link must be fitted.

Where more than one LCAM are connected back to a single Modbus master device in a “daisy chain” format, this link should only be fitted on the last LCAM in the chain i.e. the instrument at the opposite end of the daisy chain from the Modbus master device.

The Modbus address of the LCAM is based on the internal ID switch combined with the Offset, as configured using the configuration software (see LCAM User Manual). When installing, make sure that the ID switch has the correct value.



Figure 7 - ID switch

Notes on alarm relay contact connection

The alarm relays used in the LCAM are solid state relays with a rated maximum of 1A @ 240Vac. They serve the same function as electromechanical relays, but have no moving parts; therefore the relays are silent in operation. Note that solid state relays only switch when operated under load.

Notes on washer unit connection

The instrument has the capability of powering and/or controlling a suitable washer unit. Please contact Nyx Hemera Technologies for details of suitable washer systems. Washer installation details are provided in Appendix B.

Notes on external wipe connection

A suitable external wiper unit can be fitted to the LCAM. The external wipe connection allows a remote device, such as a switch, relay or PLC, to activate the wiper. Contact Nyx Hemera Technologies for details of suitable wipers.

Notes on cable screen bonding connections

All cables should be screened where possible. Cable screens must be bonded to the marked M5 stud on the inside of the enclosure.

Note: Cable screens must be bonded at the LCAM end only. They must not be bonded to any other device or connected in any way at the opposite end of the cable.

Notes on protective earth bonding connection

It is essential that the enclosure is bonded to a local protective earth connection, as described earlier in this section and shown on the wiring diagram.

Appendix A: Wall & Optional Pole Brackets

Wall Pole Bracket

The following drawings show details of the optional Wall and Pole Brackets.

Note: The brackets are available separately and at additional cost. instrument.

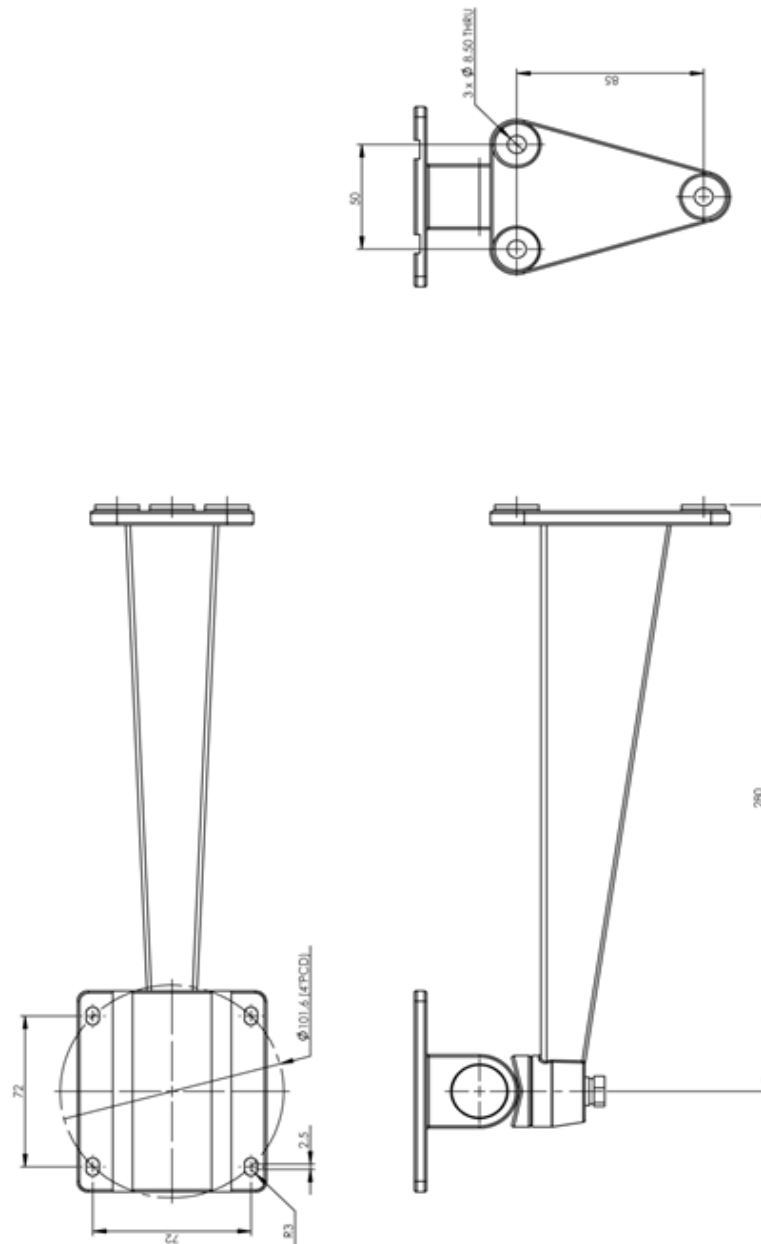


Figure 8 - Optional Wall Brackets' details

Optional Pole Bracket

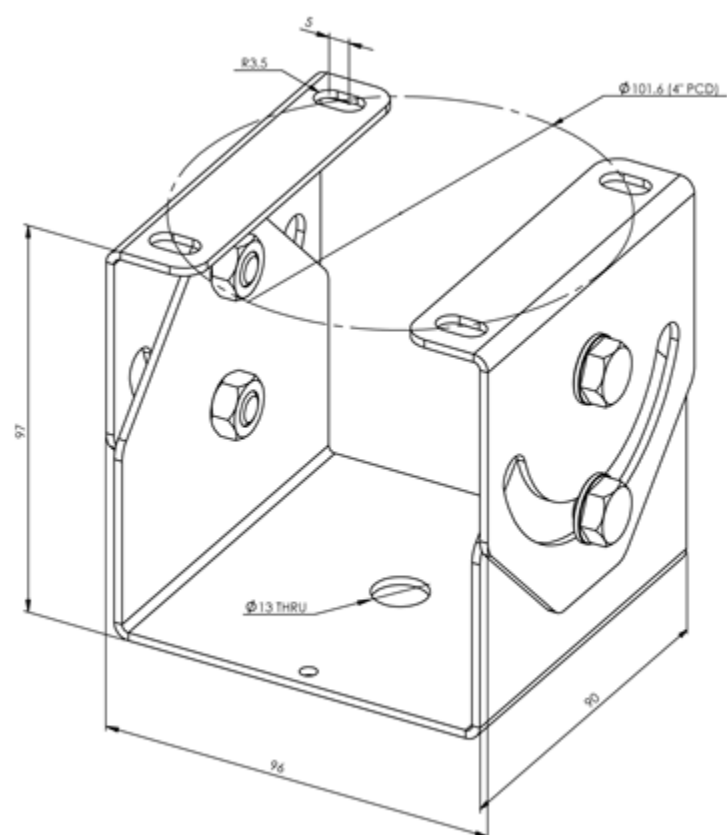


Figure 9 – Optional Pole Brackets’ details

Appendix B: Wash / Wipe System

Overview

Some applications may benefit from the use a wash / wipe system, which consists of a LCAM with integrated wiper and a separate washer unit.

The integrated wiper is a LCAM option that must be selected at time of purchase.

The washer unit is a separate accessory available from Nyx Hemera Technologies at additional cost.

The washer unit has been designed to be connected to the LCAM via a single electrical cable that provides power (24Vdc) to the washer unit and that also carries the two way signals between the washer unit and the LCAM.

LCAM has the capability to control both the wash and wipe actions, which can be programmed for frequency and duration using the IOS utility software supplied with the LCAM.

The washer unit includes a float switch which determines low fluid level and reports this to the LCAM. Furthermore the low fluid level indicator is used to disable the pump and prevent the pump from running dry in a low fluid situation.

Both the washer and the wiper can be controlled and operated by an external contact closure (a switch or relay contact). The washer unit terminals include a pair of pins for “external wash” operation and the LCAM terminals include a pair of pins for “external wipe” operation. These connections are optional.

Fixing details

The LCAM with wiper should be installed in the same manner as the standard LCAM, but with allowance for the additional bulk of the wiper unit at the front end.

The LCAM must be mounted no more than 8m above the washer unit, as the washer cannot lift the fluid any higher than 8m.

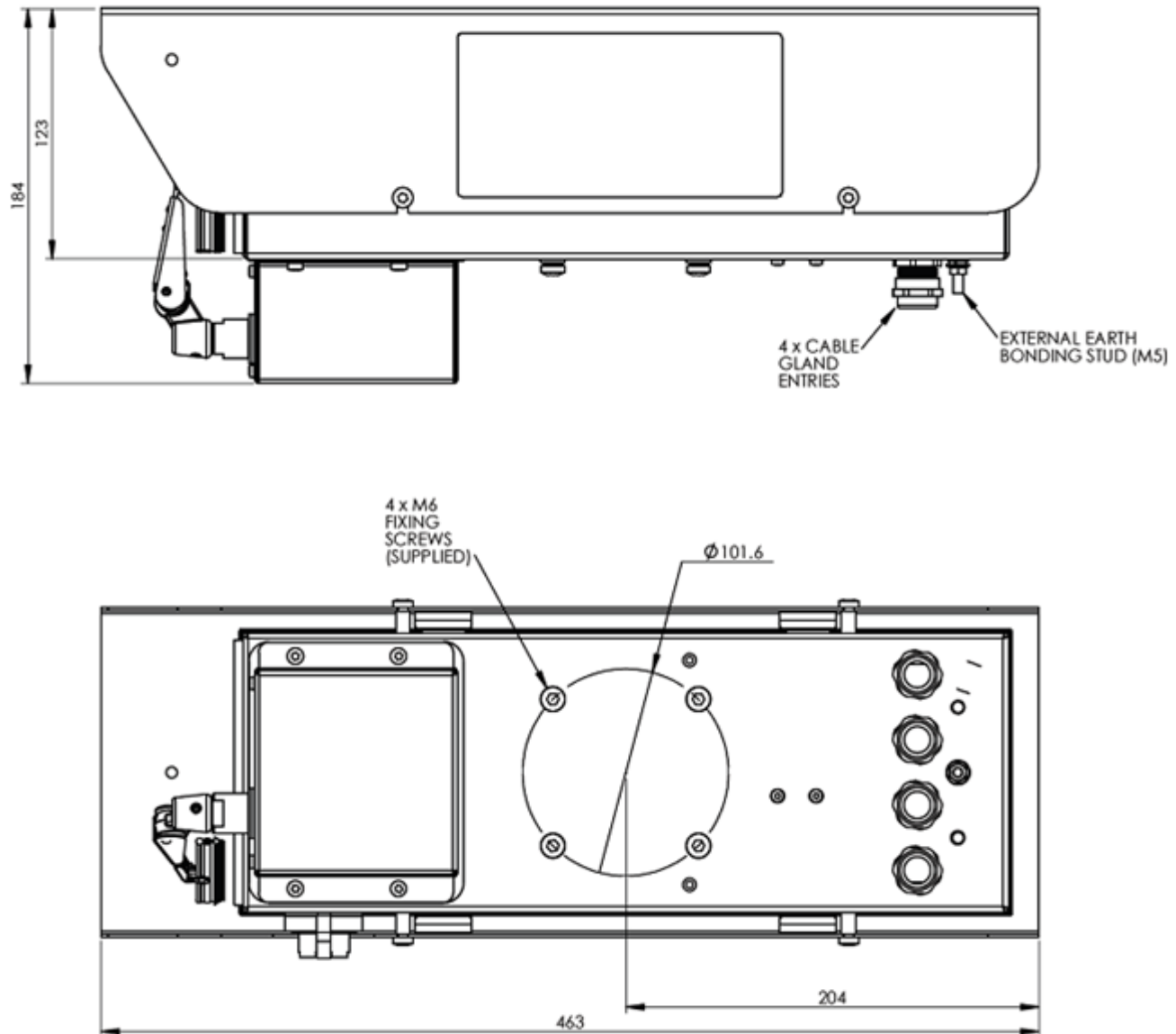
The washer unit must be mounted on a wall, post or other solid vertical face and in a position that allows access for regular refilling of the fluid reservoir.

The washer nozzle that is supplied with the washer unit must be fitted in any of the three positions available at the front of the weather shield on the LCAM. The nozzle can be adjusted to ensure that the fluid jet is directed at the face of the LCAM.

The supplied fluid hose should be connected between the nipple on top of the fluid reservoir and the washer nozzle on the LCAM.

The supplied fluid hose is 10m long and can be shortened, but must not be extended.

The following mechanical diagrams show the physical dimensions and key details of both the washer system and the LCAM with wiper option.



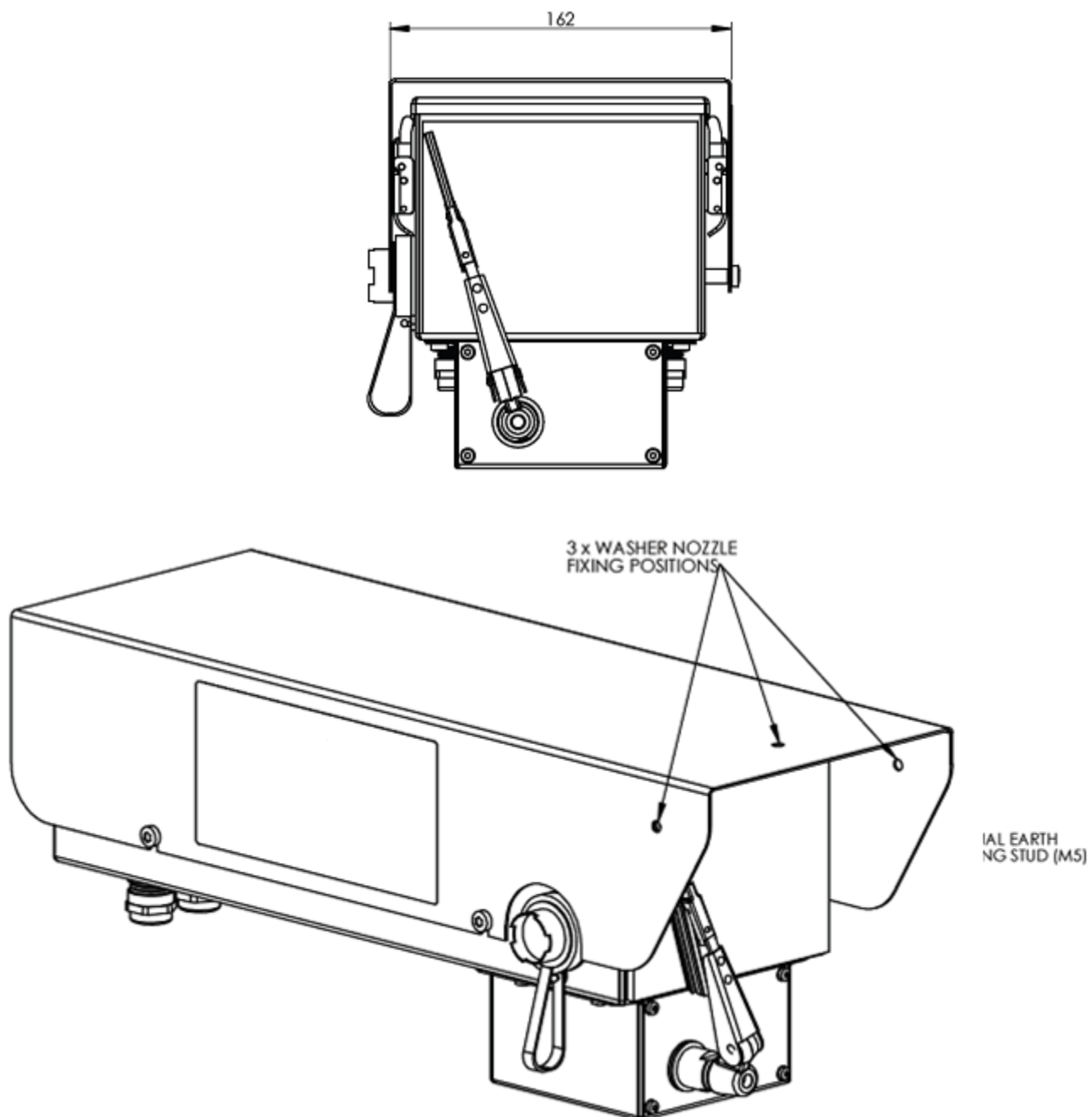


Figure 10 – LCAM's wiper mechanical diagram

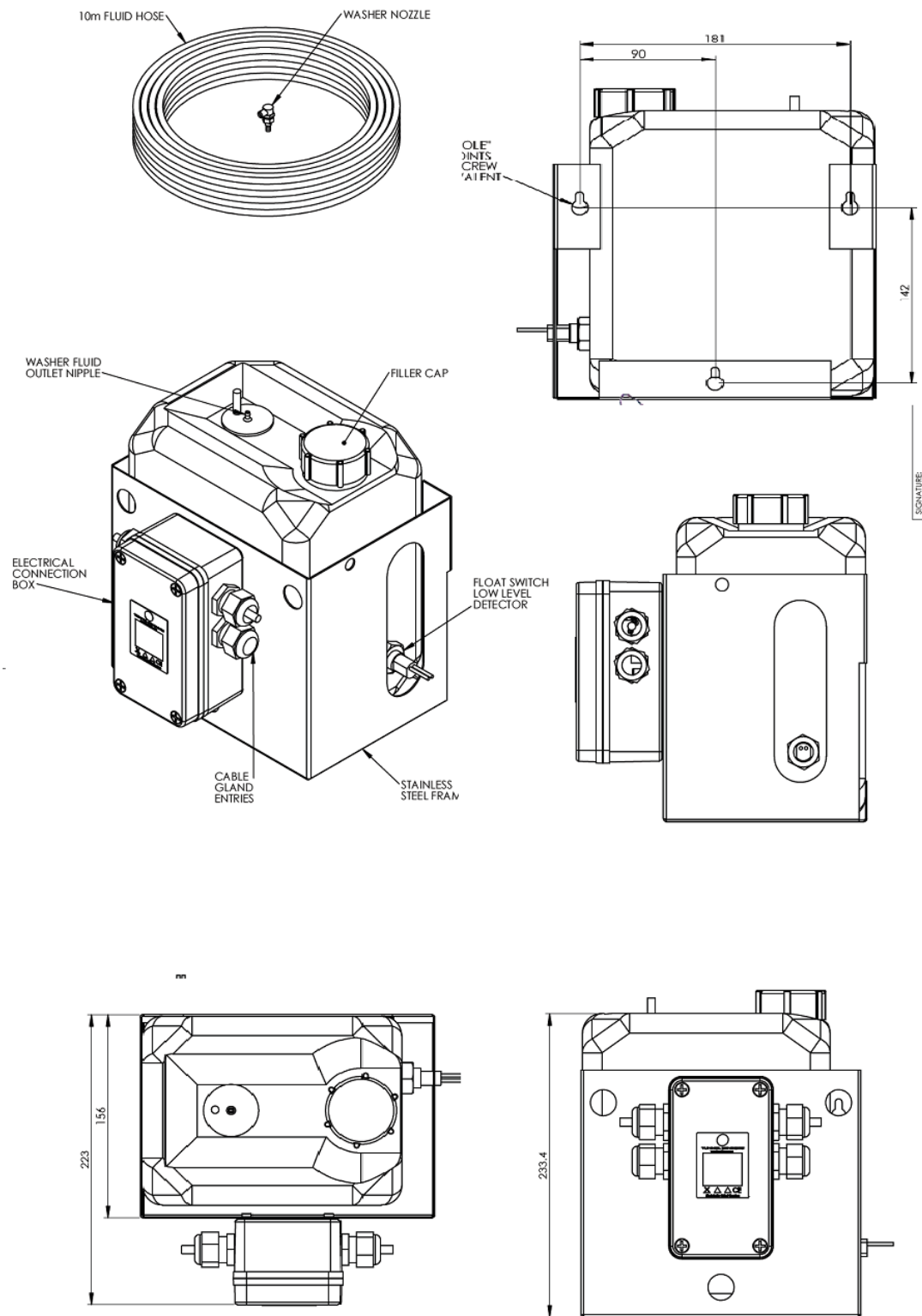


Figure 11 - LCAM's washer mechanical diagram

Installation wiring

In a standard installation, a single cable must be connected between the washer unit and the LCAM. This cable is not supplied with either the LCAM or the washer unit, however suitable cable is available as an accessory from Nyx Hemera Technologies, at additional cost.

The installation of this cable must be made with reference to all the cautions and requirements of the earlier “Electrical Installation” section, including cable specification, earth connection, sealing unused glands and ferrite tube requirements.

This cable must not exceed 20m in length and the cable screen must be bonded to the marked M5 stud on the inside of the LCAM enclosure.

Note: Cable screens must be bonded at the LCAM end only. They must not be bonded to any other device or connected in any way at the opposite end of the cable.

The following wiring diagram includes details of all connections necessary for basic functionality, and also shows the optional connections for external control of the wash / wipe.

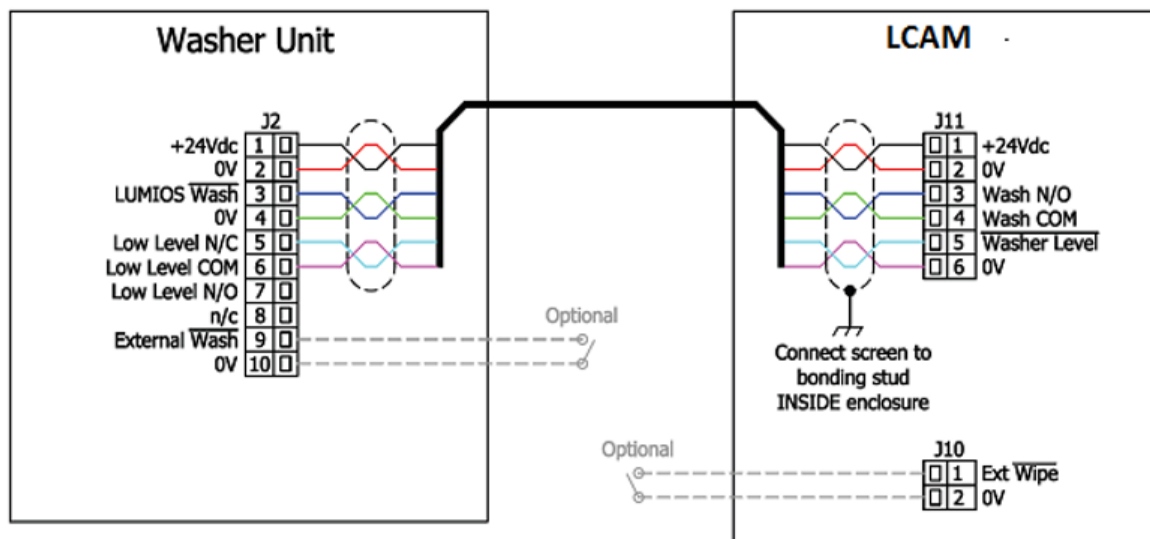


Figure 12 – LCAM-Washer unit wiring diagram

Note:

1. The cables and wires shown in the above diagram are not supplied with the instrument, unless specifically indicated, but are available as optional accessories in various lengths and at additional cost.
2. All voltage / current requirements are specified as required at the point of connection to the instrument, It is the customers responsibility to consider voltage drop across long cable lengths and to ensure that power supply voltages are within specification at the point of connection.

3. When using long cables and wires to connect together equipment that is separated by distance, it is essential to check for differences in earth potential between the different locations and to ensure that the difference is no more than +/- 5V AC or DC.
4. Making or breaking connections to the instrument whilst power is applied WILL cause damage to circuit board components and may cause failure. This "Hot plugging" includes separating / mating two part terminals, external multipole connectors and individual wire terminations. Do NOT hot plug.

Minimum cable specification (all cables):

1. Screened multi-core (preferably with drain wire)
2. Overall diameter: 6 to 12mm
3. Conductor size: 0,548mm² (20AWG) to 2.08mm² (14AWG)