Traffic Open Products and Specifications

TOPAS 2523B

Traffic Control Equipment Interfacing Specification

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TOPAS 2523 B

TRAFFIC CONTROL EQUIPMENT INTERFACING SPECIFICATION

CONTENTS

Section

CHANGE LOG

The following outlines significant changes to this specification, from its previous issue which do not impact on currently Registered products:

a. Section 1 now clarifies that Registration explicitly against TOPAS 2523 is not normally required but may still be requested by a Manufacturer if desired.
b. The requirement for the serial handset port to provide a 5v supply is no longer mandatory. (Section 2.1.1).
c. The serial handset port may now be provided either as a 25 way or 9 way ‘D’ type connector (Section 2.1.2).
d. Parallel input and output specifications have been clarified and updated to remove duplication. (Sections 2.3 and 2.4).
e. For Below Ground detectors the requirement to provide both normally open and normally closed output contacts has been clarified and combined into one section. (Previously this requirement was in two separate sections, 2.3.3 and 2.3.7).
f. Solar cell voltage options have been amended, specifically to accommodate both LV and ELV control equipment.
g. Controller signal aspect output voltage levels have been amended to accommodate both LV and ELV control equipment and to allow for distributed control systems. (Section 2.6 and Section 2.7).
h. Section 3 has been rationalised as most original content is now contained elsewhere.
i. Appendix A (street cable details) has been replaced with a reference list of UTMC Protocols which may be used to interface Traffic Control Equipment to Central Office equipment.
j. Appendix Z Registration documentation requirements simplified.

The requirements for re-registration of existing products are defined in section 1.8.

1 INTRODUCTION

1.1 This technical specification covers the United Kingdom's established interface standards for traffic control and ancillary equipment.

1.2 This document describes the interfaces that should be considered by Manufacturers of new products, who wish to offer these for use as replacement for other TOPAS Registered products or for new schemes intended to combine TOPAS Registered equipment from multiple suppliers.

1.3 TOPAS specifications are explicitly purchasing specifications and compliance with them is not mandatory. However Local and other Purchasing Authorities may typically require that equipment purchased complies with TOPAS specifications and is TOPAS Registered.

1.4 Where interfaces between different equipment types are required TOPAS 2523 is usually referenced by the relevant TOPAS specifications. Consequently, products are not typically Registered directly against this specification. However, if they wish Manufacturers may Register products as being compliant with this specification using the process defined in TOPAS 0600.

1.5 TOPAS Registration requires manufacturers submit a Technical File to an appropriate Notified Body to aid compliance verification. The content requirement for the Technical File is defined in Appendix Z of this specification.

1.6 If Registration is explicitly against this specification the Manufacturer shall define in their Registration application exactly which clauses of TOPAS 2523 are being complied with.

Implementation

1.7 This specification will be immediately implemented from the date of issue for all new TOPAS Registrations, either those directly against TOPAS 2523 or against any TOPAS specification which references TOPAS 2523.

1.8 For Products previously explicitly Registered against TOPAS 2523A, manufacturers are simply required to confirm in writing that the Products remain compliant with this amended specification. Once confirmed Product Registration information will be migrated on the TOPAS website.

No action is required for Products Registered against other TOPAS specifications which reference this specification.

Glossary of Terms

1.9 A comprehensive glossary of terms is given in Highways Agency document TA 84 Code of Practice for Traffic Control and Information Systems for All-purpose Roads.

2 CONTROLLER AND RELATED EQUIPMENT INTERFACES AND POWER SUPPLIES

Communication Interfaces

2.1 Serial Handset Interface

2.1.1 The serial interface, as commonly used for connection of the User's Terminal, shall conform with the RS 232C, CCITT V24 and V28 definition. Where a terminal supply is supported, (not mandatory), it shall provide a separately protected +5V ± 5% power supply, with a minimum current rating of 250 mA.

2.1.2 The method of connection shall be a 25 or 9 way 'D' type connector or equivalent and shall have the following pin allocations:

25 Way	9 Way	Signal
1	NC	GND
2	3	TX
3	2	RX
4	7	RTS
5	8	CTS
6	6	DSR
7	5	GND
9	NC	+5V
10	N/A	+5V
18	N/A	0V
19	N/A	0V
20	N/A	DTR

2.1.3 The Bit Format shall be in accordance with the following:

START (SINGLE BIT)		1 (LSB)	2	3	4	5	
6	7 (MSB)	PARITY (EVEN)	STOP (SINGLE BIT)				

2.1.4 Operation at minimum of 1200 Baud shall be the norm. Higher speeds may be provided.

Note: 1200 Baud is the basic common default but higher Baud rates may be employed.

2.1.5 The Mode shall be full duplex.

2.1.6 The Character set shall be ISO Alphabet No. 5 (ASCII).

2.2 Below Ground Detector Physical Interface

2.2.1 The below ground detector interface may be the 64 way DIN 41612 connector and where used the pin allocations shall be as defined in TOPAS 2512.

2.3 Parallel Inputs Interface

2.3.1 The parallel input interface is for connection of external ancillary equipment, e.g. vehicle and pedestrian detectors, outstation transmission units, MOVA units, etc, to control or monitoring equipment.

2.3.2 The open circuit voltage generated at the terminals of the equipment providing the input, shall not exceed 50 V dc, and the short circuit current provided shall be a maximum of 50 mA dc.

2.3.3 The logic '1' (active) state shall normally be determined when the resistance across the input terminals is 250 Ω or less, typically the loop resistance of 400 metres of cable having a core size of 0.5 sq mm in series with a protection resistor of 180 Ω.

2.3.4 The logic '0' (inactive) state shall normally be determined when the equipment senses an open circuit, represented by an impedance of greater than 100 kΩ.

2.3.5 Except where otherwise stated, the equipment shall interrogate input signals at intervals of not greater than 40 milliseconds.

2.4 Parallel Output Interface

2.4.1 The output from detecting or other equipment shall be via isolated contact, or compatible solid-state equivalent, which shall have dc isolation from earth and from power supplies to the equipment. If the output is polarity sensitive, a means shall be provided to protect the output against accidental reversal of current flow.

2.4.2 For the isolated output the logic '1' (active) state on the output terminals shall continuously present a maximum resistance of 180 Ω + 5% and shall be able to withstand a current of at least 50 mA. The output shall continuously allow a current of 50 mA to pass with a volt drop of no more than 2.5 V.

2.4.3 The logic '0' state on the output terminals shall continuously present a resistance greater than 100 kΩ, and shall be able to withstand a continuous voltage of up to 75 V dc.

2.4.4 Output signals generated by the equipment shall not be shorter than 50 milliseconds.

2.4.5 Below Ground Vehicle Detectors to TOPAS 2512 shall provide options to connect both:

a) A 'normally open' output, (resistance greater than 100kΩ), which changes to a closed circuit (resistance no greater than 180 Ω +5%) while a target object is being detected or the detector is not powered.

b) A 'normally 'closed' output (resistance of less than 180 Ω +5%) which changes to an open circuit (resistance greater than 100 kΩ), while a target object is being detected or the detector is not powered.

2.4.6 The output from Pedestrian Pushbuttons is normally expected to be open circuit, changing to closed circuit when signalling a demand. This allows more than one push button to be connected in parallel to the same equipment input.

2.4.7 Further interface requirements for outstation transmission units or MOVA units are defined in Section 4 Urban Traffic Control (UTC).

2.5 Solar Cell

2.5.1 Traffic Signal Control equipment shall provide a pair of terminals to interface with a Solar Cell to instigate signal dimming.

2.5.2 The Solar Cell shall operate on nominal 48/230 VAC, or 12/24/48 VDC depending on the system specification. The solar cell will switch the supply voltage such that no supply voltage present on the controller solar cell input shall be interpreted as bright and supply voltage on the controller solar cell input shall be interpreted as dim. (The Controller manufacturer shall define which solar cell voltage shall be used).

2.5.3 The Solar Cell shall change the state from bright to dim when the ambient light falls below 55 Lux.

2.5.4 The Solar Cell shall change the state from dim to bright when the ambient light rises above 110 Lux.

2.5.5 Traffic Signal Control equipment shall be designed such that if the Solar Cell fails to indicate a state change within a 24-hour period it will cause all signals and pedestrian indicators to switch to the 'bright' state.

Power Supplies

2.6 Signal Aspects

2.6.1 Where signal phase drive equipment is used to centrally switch signal aspects, each signal phase drive equipment shall be capable of switching between 0.05 and 2A per phase colour, at one or more of the following voltages:

- LV*: 100V to 253 AC RMS.
- ELV (1) 20-55V AC RMS.
- ELV** (2) 22-58V AC RMS /DC full wave rectified, unsmoothed, derived from 50Hz AC.
- ELV** (3) 22 to 58V Smooth DC.
- ELV (4) 10.8 to 13.2V Smooth DC.

* It should be noted that pedestrian signals must not be switched with an LV supply.

** In accordance with CLC/TS 50509.

Where phase drive supplies are derived from connection to a public mains supply this should be taken as 230V AC +10% -13% with an operating frequency range of 50Hz + 4% … -6%. The switching devices are either 'volt free' relay contacts or a solid-state equivalent.

2.6.2 Only one of these voltage ranges will be connected at any one time

2.6.3 For distributed systems, where conventional aspect switching is not employed, the lamp switching, capacities, drive voltages and dimming strategies shall be defined by the manufacturer.

2.7 Dimming

2.7.1 The output voltage of the phase drive equipment shall be capable of automatically switching to a lowered voltage to reduce the intensity of the signals.

2.7.2 The Signals Controller shall include a dimming voltage where centrally switched as follows:

- LV: 120,140,160 ±5 V AC RMS.
- ELV (1)* 25, 29, 33 ±5V AC RMS.
- ELV (2) 27.5 ±5.5V AC RMS /DC full wave rectified, unsmoothed, derived from 50Hz AC.
- ELV (3) 27.5 ±5.5V Smooth DC.

For LV and ELV (1) Tolerance allows for nominal supply voltage and full load conditions.

*ELV (1) is typically only provided in legacy systems and is usually derived from transformers located in signal heads to drive Wait and Nearside indicators.

Note: For portable and temporary signals see the relevant TOPAS specification for dimming specifications.

2.7.3 Only one of these voltage ranges will be connected at any one time.

2.8 Audible and Tactile Units

2.8.1 The supplies for the Audible and Tactile units shall be interlocked so that they are only present when the pedestrian green signal is activated.

2.8.2 The supply for Audible and Tactical units may be derived from the Signal Aspect or other interlocked source, but shall be transformed to an ELV supply, in accordance with section 2.6.1.

2.8.3 A 'gating' signal of 9 to 30 V dc shall be provided to enable the operation of the tactile unit to be limited, for example to operate the tactile for a reduced period at the start of the steady green (as defined in TOPAS 2500).

2.8.4 The current capacity of this interlock supply shall be at least 100 mA for junction controllers and 50 mA for stand-alone pedestrian controllers.

2.9 External OTU, OMU and MOVA units

2.9.1 For mains powered traffic signal control products a 5 amp fused supply shall be provided for external OTU, OMU or MOVA units.

2.10 Vehicle and Pedestrian Detectors

2.10.1 Where a detector power supply is provided by the control equipment it shall be one of the following.

- 24 V DC ± 20%.
- 24VAC RMS +13% and -10%.

2.11 Nearside Signal, Demand Accepted Indicator

2.11.1 The operating voltage for these devices shall be in accordance with section 2.6.1, ELV supplies only. (The manufacturer shall specify which voltage ranges the indicators are designed to operate with).

2.12 Regulatory Signs

2.12.1 Where signals are centrally switched an additional supply shall be provided with a separate fuse or circuit breaker, at one of the following voltages ranges for Regulatory signs:

- LV: 230 AC RMS (Tolerance as per incoming mains supply – see section 2.6.1).
- ELV (1) 48 ±7V AC RMS
- ELV (2) 48 ±5.5V AC RMS /DC full wave rectified, unsmoothed, derived from 50Hz AC
- ELV (3) 48 ±5.5V Smooth DC
- ELV (4) 10.8 to 13.2V Smooth DC

3 ANCILLARY EQUIPMENT

3.1 Accommodation of Ancillary Equipment on traffic signal controllers

3.1.1 A mounting rack of full or half width to IEC 297 Standard (w483mm×h222mm×d306mm) shall be provided within the traffic signal controller. The depth of 306mm does not include an additional provision of 26 mm in front of any ancillary equipment.

3.1.2 Access to the rear of any ancillary equipment unit shall be provided when the unit is fitted in the position allocated within the controller cabinet. Where there is no direct access to the rear the unit shall be mounted on sliding rails or other means to facilitate access.

4 URBAN TRAFFIC CONTROL (UTC)

4.1 General

4.1.1 In the UTC mode of control, the permanent traffic signal controller shall be controlled either by a remote computer, via a data transmission system, or by a MOVA unit, which may be either integral to the controller or installed as an ancillary item and connected to the signal controller via the UTC interface.

4.1.2 More details SCOOT (**S**plit, **C**ycle and **O**ffset **O**ptimisation **T**echnique) and MOVA (**M**icroprocessor **O**ptimised **V**ehicle **A**ctuation), can be found at trl.co.uk

4.1.3 This section details the operation and facilities of the signals controller to be compatible with existing UTC systems under remote computer control and with existing MOVA equipment under local control.

4.1.4 The facilities described in this section shall be available in any combination, as required by the Purchaser. The controller shall operate as indicated by this section when used in a UTC system to UTMC UM/008 Full UTC MIB. Details available from utmc.eu

4.1.5 Controllers that become part of a UTC system shall comply with one of the following options.

a) ***Option 1*** permits force signals to behave as though simultaneous demand bits were transmitted.

b) ***Option 2*** allows a measure of vehicle-actuated operation during the UTC cycle.

4.1.6 When operating under UTC, the Controller shall operate in a stage-based manner, whereby it is necessary to allocate phases to stages, such allocations being conditioned by the traffic requirements and safety constraints.

4.1.7 Designations of control/reply signals (see clauses 4.4 and 4.5) are those commonly used. Others may be used where a need is identified.

4.1.8 Integral MOVA may be used as a fall–back mode for UTC.

4.1.9 The controller shall not accept a change of the control signal condition presented at the OTU/controller interface until the signal condition has persisted for two successful controller-scans to ensure valid data. The time between scans shall not exceed 400 milliseconds. The controller shall not accept any control signals shorter than 10 milliseconds. The controller reply signals presented at the OTU/controller interface shall be updated simultaneously at least once per controller scan.

4.2 OTU/Controller Interface – Ancillary

4.2.1 The Controller shall be linked to the transmission system by an OTU or integral interface that has been designed to UTMC UM/008 Full UTC MIB. which is normally housed within the Controller cabinet.

4.2.2 Control and reply information between an OTU and the signal controller shall be presented at the OTU/Controller interface.

Interface Signal Conditions

4.2.3 The logic conditions are defined as follows:

Method 1

a) a logic condition '0' represents the inactive state and, where relevant, will be the closed circuit condition across the controller input terminals and the closed circuit condition across the controller output terminals of the OTU/Controller interface;

b) a logic condition '1' represents the active state and, where relevant, will be the open circuit condition across the controller input terminals, and the open circuit condition across the controller output terminals of the OTU/Controller interface.

4.2.4 This may present a compatibility problem with some existing ancillary equipment. As an option it may therefore be possible to configure the logic conditions as per method 2.

Method 2

a) A logic '0' condition represents the active state and, where relevant, will be the closed circuit condition across the controller input terminals and the open circuit condition across the controller output terminals of the OTU/Controller interface.

b) A logic '1' condition represents the idle state and, where relevant, will be the open circuit condition across the controller input terminals, and the closed circuit condition across the controller output terminals of the OTU/Controller interface.

4.3 OTU/Controller Interface – Integral

4.3.1 It may be possible for a manufacturer to supply equipment with the OTU function integrated into the controller logic. Such an integrated system will interface to the transmission lines subject to the relevant Clauses of MCE 0312 in particular chapter 4 (except for clause 4.12), and chapter 5. The OTU function need not interface to all the variants of data transmission formats in current use.

4.3.2 When the integrated OTU facility is used, a manufacturer shall be able to provide facilities for switched signs and/or remote pelican controllers or any other item of equipment controlled via the interface.

***Note**:* With a separate OTU such signals would be derived directly from the OTU input/output interface in accordance with the Standard Interface requirements defined in clauses 2.2 and 2.4.

4.3.3 It shall be possible to configure control and reply bits between the OTU and the controller. This may be via a handset.

4.4 Control Signals (Originating externally to the controller)

4.4.1 It shall not be possible for any single control signal or for any combination of control signals in any sequence, to modify the duration of any minimum green period or fixed intergreen period.

4.4.2 Table 4.3 refers to junction control functions; Table 4.4 refers to stand–alone functions and Table 4.2 details functions that are common to both.

Stage Demand Bits DX and D1, D2 etc.

4.4.3 **Common Demand Bit (DX)**. Condition '1' on the DX control bit shall simulate the operation of detector inputs to the controller from detector equipment on vehicle actuated stages and, where specified, on pedestrian stages by simulating demands or demands/extensions for selected phases associated with each of the stages. Exceptionally, (where specified), certain stages may be excluded from this common demand. DX shall not inhibit the operation of the pedestrian push buttons and/or vehicle or pedestrian detectors.

4.4.4 **DX Bit and Other Methods of Control**. The DX function shall be fitted to all controllers equipped for the UTC method of control and may operate in any mode.

4.4.5 **DX and Option 1 Strategy**. For controllers operating the UTC method of control to OPTION 1 strategy, DX shall simulate the operation of all detectors. Under other methods of traffic control DX will simulate the operation of detectors on all vehicle actuated stages and, (where specified), of pedestrian demands.

4.4.6 **DX and Option 2 Strategy.** For controllers operating to OPTION 2 strategy, DX will simulate the operation of detectors on all vehicle-actuated stages and (where specified), of pedestrian demands under either remote computer control or local operation. Means shall be provided of allocating phase detectors to stages.

4.4.7 **DX Operation and VA Operation.** The Common Demand bit (DX) shall cause each of the stages called by DX to run for its fixed maximum. The continuous presence of DX shall cause the controller to serve the demanded stages in cyclic order.

4.4.8 **DX Operation with F Bits (optional).** With this option some stages will be declared demand dependent. Such demand dependent stages will only respond to an F bit either when a local demand exists or when a DX bit is sent with the F bit. E.g. F1 = go to stage 1 if a local demand for stage 1 exists; F1.DX = forces controller to stage 1.

4.4.9 **Demand Bits and the Detector Fault Monitor.** The Common Demand bit (DX) and the individual stage demand bits D1, D2 etc shall not influence the Detector Fault Monitor.

4.4.10 **Individual Computer Stage Demand Bits (D1, D2 etc)**. Where specified in the Works Specification certain stages may be demand dependent each with its own demand bit.

4.4.11 **Logic Conditions for Stage Demand Bits**. Condition '1' on a stage demand bit (D1, D2 etc.) shall simulate the operation of a detector by simulating the demands and extensions for selected phase(s) associated with the stage.

4.4.12 **Insertion of Stage Demands.** Stage demands may be derived from:

a) Common Demand Bit (DX);

b) Individual Stage Demand Bits (D1, D2 etc);

c) Pedestrian Push Buttons (with pedestrian detection in the case of Puffins);

d) Vehicle Detectors.

4.4.13 **Non–Demand Dependent Stage.** In the UTC method of control the non–demand dependent stages (i.e. stages not covered by DX, or D1, D2 etc) will behave as though a demand signal has been received simultaneously with the corresponding force signal. (This is to cater for Option 1 strategy.)

Latching and Non–Latching Demands.

4.4.14 Computer stage demands (DX, D1, D2, etc) may be latched or not latched in accordance with the site specific requirements and will simulate street detection with the following exceptions:

a) timing delays associated with the delayed call/cancel facilities are not applicable to computer demands, (i.e. the presence of a computer demand associated with the call/cancel facility shall cause an immediate demand for the associated phase to be registered). Removal of the computer demand shall remove the associated phase demand unless this is also generated by street detection;

b) the condition where a turning phase demand is active only if another selected phase demand is present, shall not be overridden by a UTC computer calling for the stage which runs the turning phase.

4.4.15 **Servicing of Stage Demands.** The servicing of demands shall be subject to traffic movement constraints specified in TOPAS 2500 and to the presence of force bits.

4.4.16 When there are no force bits present, the controller will revert to the fall–back method of control as required by TOPAS 2500.

4.4.17 A demand for a stage may either extend that stage or request the stage to run according to the following provisions:

a) a VA stage already having right–of–way:

i) if an extendable stage already has right–of–way, a demand shall hold the vehicle extension timer reset and, on release of the demand, the vehicle extension timer associated with the stage shall become operative;

ii) if at any time the maximum timers for the relevant phases in the stage expire then the required stage change away from this stage shall occur and the demand shall then be treated as a demand for a stage not having right–of–way. Only the maximum timers for those phases, which do not run in the next stage, are regarded as relevant.

b) Stages not having right–of–way:

i) If a stage does not have right–of–way, a demand for the stage shall request the stage.

Force Bits (F1, F2 etc.)

4.4.18 The controller shall assume the UTC method of traffic control within 400 milliseconds of a force bit being accepted or, conversely, in the absence of force bits, the controller shall revert to the fall–back method of traffic control within 400 milliseconds. This time may be additional to the time required to ensure valid data, as detailed by clauses 4.2 and 4.3.

4.4.19 The forced change to the selected stage shall not contravene any restrictions upon stage-to-stage movements that may be imposed by the requirements of TOPAS 2500.

4.4.20 Condition '1' shall force the controller to make an immediate change to the selected stage or shall hold a selected stage subject to the following conditions:

a) if the selected stage does not have right–of–way then condition '1' on the force bit for that stage, and no other, shall cause a forced change to that stage provided that a demand exists or is assumed to exist for the stage;

b) if the controller is in an intergreen or a minimum green period, the change to the selected stage shall be deferred until the expiry of the minimum green period, provided that the force condition still exists;

c) if the selected stage has already appeared, condition '1' on the force bit for that stage shall reset the phase maximum timers and hold that stage for so long as the condition '1' is received, provided that gap changes to another demanded stage are prevented by vehicle extensions (e.g. either by control demand signals or from local detectors).

4.4.21 Where called for in the Works Specification, it shall be possible for a stage to behave as though a control demand signal (D1, D2, etc) has been received simultaneously with the corresponding force signal, even though no such demand signal has been transmitted.

4.4.22 A facility shall be provided to time–out force bits such that if an F bit(s) is unchanged for longer than a predetermined time the controller shall revert to the fall–back method of control. This time shall be preset at a value in the range between 120 and 300 seconds, and adjustable in incremental steps no more than 10 seconds. If no time is specified then a default of 200 seconds shall be set. This facility shall not be provided if the MOVA Take Over (TO) but set to '1'.

4.4.23 If condition '1' is received on the force bits for more than one stage simultaneously then the controller shall respond as in Table 4.1.

Switch Facility (SF1, SF2, etc.)

4.4.24 Condition '1' shall switch a specified miscellaneous facility, (e.g. a regulatory traffic sign). Interfacing directly to the specified OTU output terminal or via the controller may provide this facility.

4.4.25 If required by the Works Specification this facility may be associated with a nominated stage or phase so that a sign will only switch 'ON' at the start of the nominated stage and shall only be extinguished at the start of a nominated stage or phase green.

4.4.26 If required by the Works Specification the command to switch the facility shall remain in the '1' or the '0' states for a period of between 7 and 10 seconds before the facility is switched on or off. Where the switching action is associated with a stage the time period shall have expired before the start of the stage for the switching action to take place.

4.4.27 The condition '1' shall be the fall back condition and where relevant should be associated with the safe state of the sign as defined in the Works Specification.

4.4.28 Where this facility is used to control a sign, phase-aspect drive equipment may be used for this purpose.

Hold Vehicle (PV)

4.4.29 Condition '1' shall prevent the appearance of the pedestrian stage by the imposition of a 'hold' condition on the vehicle stage. All pedestrian demands which have not been served, or which occur during the 'hold' period, shall be stored and allowed to mature in a normal manner when the PV signal ceases.

Pedestrian Demand (PX)

4.4.30 Condition '1' shall demand the pedestrian phase. This facility should function even if the output from the kerbside detector is inactive.

Solar Switch Override (SO)

4.4.31 Condition '1' shall switch the traffic signals to the non–dimmed condition, overriding the Solar Switch.

4.4.32 Condition '0' shall not override the solar switch.

CLF Group Timer Synchronisation Signal (SG)

4.4.33 Receipt of an external signal, having the series message format '1, 0, 1' (received over three consecutive transmission message cycles), shall cause the CLF to commence the relevant plan cycle timing from the start of the first group within 1 second ±5% of the '0' to '1' transition of the synchronising message. The Group Timer synchronising signal shall take effect at the receipt of the second '1' providing the Group Timer synchronising signal has been correctly received.

4.4.34 The synchronisation request shall not be accepted if the duration of each '1, 0, 1' bit is not 1 second ± 400 ms.

Signal Aspect On/Off (LO)

4.4.35 Where a condition '1' exists for a minimum of 10 seconds, the signals shall switch on in accordance with the Start Up Sequence.. Where a condition '0' is present for a minimum of 10 seconds, the signals shall switch off during a nominated stage, provided that all minimum running periods have expired.

Local Linking Inhibit (LL)

4.4.36 Condition '1' shall inhibit local linking between parallel stage streams, or other local links as specified in the Works Specification.

Time Synchronisation Signal (TS)

4.4.37 Receipt of an external signal, having the series message format '1, 0, 1' (received over three consecutive transmission message cycles), shall cause the controller clock to reset to 00:00 hours or other configured time to the nearest ½ second. The controller synchronising signal shall take effect at the receipt of the second '1'.

4.4.38 The synchronisation shall not respond to the message format if the duration of each '1, 0, 1' bit lasts for less than one second.

Fall Back Selection (FM)

4.4.39 When the signal controller is not in the UTC mode, condition '1' shall inhibit CLF mode and cause the controller to revert a lower priority method of traffic control, e.g. vehicle actuated or fixed time. Condition '0' shall have no effect.

Take Over (TO)

4.4.40 This facility shall allow control to be accepted from a remote source. While the TO bit is set to logic '0' (inactive condition) the controller shall ignore the control bits specified in an associated works specification

4.4.41 Where an ancillary MOVA unit is specified and control is via the UTC interface, control shall only be operational when the Take Over bit (logic condition '1') is present

Hurry Call Inhibit (HI)

4.4.42 Logic condition '1' shall inhibit Hurry Call Requests.

Transmission Confirm (TC)

4.4.43 The TC bit shall be set to logic condition '1' when a validated control message has been received by the OTU. When the TC bit is set to logic '0' (inactive condition) the controller shall ignore all control data from the OTU.

Close Car Park (CP)

4.4.44 Logic condition '1' shall close the car park.

4.5 Reply Signals

4.5.1 The signal controller shall return reply signals via the OTU to indicate any of the functions specified below. The appropriate reply signals shall be present in all methods of traffic control. Condition '1' indicates the active facility in all cases.

4.5.2 Table 4.3 refers to junction control functions,

4.5.3 Table 4.4 refers to stand–alone functions and

4.5.4 Table 4.2 details functions that are common to both.

Stage Confirmation (Gn)

4.5.5 Condition '1' confirms that a particular stage, or phase if specified is running.

4.5.6 G1 and G2 shall normally be returned simultaneously to indicate that one of the following has occurred:

a) the mains supply to the signal aspects is off;

b) manual method of traffic control is either in operation or requested;

c) The traffic controller is switched off;

d) The traffic controller has failed or shut down due to a fault;

e) The interface between the OTU and the controller has been disconnected.

Vehicle Stage Green Confirmation (GX)

4.5.7 Condition '1' confirms that a green signal is displayed to vehicles on a stand–alone controller. When the signals are not on stage green, or when the controller or signals are switched off, the indication returned shall be condition '0'.

Detector Fault Monitor (DF)

4.5.8 Condition '1' confirms that the detector fault monitor system indicates a detector failure.

Fall Back Selection Confirmation (FC)

4.5.9 Condition '1' confirms that the Fall Back selection facility has been introduced.

Switch Facility Confirmation (SCn)

4.5.10 Condition '1' confirms that a particular Switch Facility has been introduced.

Hurry Call Confirmation or Request (HC)

4.5.11 Condition '1' confirms that a Hurry Call request has been requested or is being actioned, as specified in an associated Works Specification.

Wait Indicator Confirm (WI)

4.5.12 Condition '1' confirms that the WAIT indicator (Pelican) or the Pedestrian Demand Accepted (Puffin) is energised at stand-alone crossings.

Pedestrian Stage Green Confirm (PC)

4.5.13 Condition '1' confirms that the pedestrian green signal is energised. Condition '0' shall be given when the controller or signals are switched off. This can apply to junction or stand–alone facilities.

Puffin Pedestrian Clearance Period (PR)

4.5.14 Condition '1' confirms that the pedestrian clearance period is operative. Condition '0' shall be given when the controller or signals are switched off.

CLF Group Timer Synchronisation Confirm (CG)

4.5.15 A signal shall be returned to the OTU/controller interface when the synchronising signal has been correctly received and actioned. This reply signal (condition '1') shall be normally maintained for a period of 3 seconds ±1 second or as specified in the Works Specification.

4.5.16 As an option the CG bit may confirm the time of day and day of week in the controller clock. The CG bit may be set to condition '1' (active) at a predetermined period after the controller synchronisation time. The length of time the signal is held active shall indicate the day of the week as follows:

Sunday	3 seconds
Monday	5 seconds
Tuesday	7 seconds

Wednesday	9 seconds
Thursday	11 seconds
Friday	13 seconds
Saturday	15 seconds

Group 1 Indication (GR1)

4.5.17 That CLF is in the first group. This reply signal (condition '1') shall be maintained for a period of three seconds ±1 second.

Stage Demands (SDn)

4.5.18 Condition '1' confirms that a demand exists for a stage.

Manual Control (MC)

4.5.19 Condition '1' confirms that Manual Control is either in operation or requested as specified in an associated Works Specification.

Controller Fault Indication (CF)

4.5.20 Condition '1' confirms that an entry is in the system fault log.

Signal aspects Extinguished Indication (LE)

4.5.21 That the mains supply to the signal aspects has been interrupted by:

a) operation of the signal aspect switch, or;

b) the signal aspect fuse being blown, or;

4.5.22 the controller mains supply being off (only in the case of a separately powered OTU).

4.5.23 This may include part time signal operation.

Remote Reconnect (RR)

4.5.24 As an optional facility, the controller may be released from remote control due to manual intervention and should be specified in an associated Works Specification. Condition '1' shall request release and condition '0' shall be returned to request re–establishment of remote control (see Clause 4.5.19).

Signal aspect Failure (LFn)

4.5.25 Condition '1' confirms that one or more traffic signal aspects have failed, where these are monitored.

Vehicle Red Signal aspect Failure (RF1)

4.5.26 Condition '1' confirms that at least one vehicle red signal aspect has been accepted as failed where these are monitored for Part Time or Pedestrian Audible/Tactile Control.

Vehicle Red Signal aspect Failure (RF2)

4.5.27 Condition '1' confirms that a second vehicle red signal aspect has been accepted as failed on an approach, or a vehicle red signal aspect feed has failed where these are monitored for Part Time or Pedestrian/Audible Tactile Control or the Red Signal aspect monitor has failed.

Emergency Vehicle (EV)

4.5.28 Condition '1' confirms that the controller is servicing a priority call, other than a hurry call.

Vehicle Count (VC)

4.5.29 A count of the number of vehicle pulses scaled by a predetermined scale factor.

Queue Detector (VQ)

4.5.30 Condition '1' confirms that the Vehicle Queue Detector indicates a queue state.

Car Park Occupancy Threshold Exceeded (CA)

4.5.31 Condition '1' confirms that the car park occupancy threshold is exceeded.

Queue at Car Park Reservoir (CR)

4.5.32 Condition '1' confirms that a queue state exists at the car park entry reservoir.

Car Park Closed (CL)

4.5.33 Condition '1' confirms that the car park is closed.

Car Park Information (CSn)

4.5.34 Condition '1' indicates the state of specified signs associated with the car park.

Handset Connected (TF)

4.5.35 Condition '1' confirms that the handset equipment is connected to the Terminal interface.

SCOOT Detector Output Presence (VSn)

4.5.36 Condition '1' is the active output state on a SCOOT detector.

***Note**:* These are four sample bits/second/ detector.

Cabinet Door Open (CO)

4.5.37 Condition '1' confirms that the cabinet door is open.

4.6 UTC Control of Stage Streams

4.6.1 Stage streams shall be controlled by UTC according to one of the following 3 options, any of which it shall be possible to specify.

Option A, Master–Master Linking

4.6.2 Control shall be achieved by separate forces to each stream. For the computer method of traffic control to operate on any stream, force bits are required to be present for all streams. If force bits for any of the streams are absent, the controller will revert to the standby method of traffic control except when control bit, LL, is present.

Option B, Master–Slave Linking

4.6.3 Only the master stream is required to be computer controlled. The slave streams shall either be computer controlled or under the control of master–slave cross–linking. Under this option the computer method of traffic control does not operate if force bits for the master stage stream are absent, except when control bit, LL, is present.

Option C, Unlinked

4.6.4 Streams with no cross–linking constraints shall have completely independent computer control for each stream. The method of traffic control of one stream shall have no effect on the method of control of any other stream.

Stage Stream Routining

4.6.5 Where stage streams are cross–linked to an extent which would inhibit the normal UTC night–time routining, it shall be possible (subject to safety considerations) to arrange for specific cross–linking to be disabled. This shall be achieved by the use of a specific local linking inhibit bit (LL) sent by the computer. It shall also be possible for the receipt of LL with force bits for one stage stream to modify other cross–linking constraints if specified.

Current Stage	***Condition***	***Option 2***	***Option 1***
Controller already on one of stages for which a force bit is being received	1. No demands	Hold current stage indefinitely.	Hold current stage Indefinitely.
	2. Demand (Ext) for current stage		
	3. No demand for current stage, demand for other forced stage(s).	Change to next forced stage in cyclic order.	
	4. Demands for stage(s) other than forced stage(s).	Change(s) to demanded stage(s).	
Controller <u>not</u> already on one of the stages for which a force bit is being received.	1. No demands.	Hold current stage.	If both forced stages are demand dependent – hold current stage. If either of the forced stages is not demand dependent then demands are assumed and a move to the next forced (and demanded) stage in cyclic order is made, and is then held indefinitely.
	2. Demand for one of the forced stages.	Move to demanded stage and hold.	Move to next forced (and demanded) stage in cyclic order and hold.
	3. Demand for two or more forced stages.	Move to next of the forced stages in cyclic order and hold.	Move to next of the forced stages in cyclic order and hold.
	4. Demands for stages other than forced stages.	Move to demanded stages in cyclic order. (Dependent on traffic movement constraints.)	If both forced stages are demand dependent, hold current stage. If either of the forced stages is not demand dependent then move to the next forced (and demanded) stage in cyclic order and hold.

Table 4.1 – Simultaneous Force Bits

Control		Description	Reply	
Designation	**Clause**		**Clause**	**Designation**
SFn	4.4.24	Switch Facility	4.5.10	SCn
SO	4.4.31	Solar Override		
SG	4.4.33	CLF Group Timer Synchronisation	4.5.15	CG
LO	4.4.35	Signal aspects On/Off	4.5.21	LE
LL	4.4.36	Local Link Inhibit		
TS	4.4.37	Time Switch Synchronisation to Stored Value (or Nearest ½ Min)		
TO	4.4.40	Take Over		
TC	4.4.43	Transmission Confirm		
CP	4.4.44	Close Car Park	4.5.33	CL
		Detector Fault Monitor	4.5.8	DF
		CLF Group Timer in First Group	4.5.17	GR1
		Remote Reconnect	4.5.24	RR
		Entry in Controller Fault Log	4.5.20	CF
		Handset Connected	4.5.35	TF
		Signal aspect Fault	4.5.25	LFn
		Car Park Occupancy Threshold Exceeded	4.5.31	CA
		Pedestrian Green Confirm	4.5.13	PC
		Queue Detector Presence	4.5.30	VQ
		Detector Vehicle Count	4.5.29	VC
		Car Park Information	4.5.34	CSn
		Queue at Car Park Entry Reservoir	4.5.32	CR
		SCOOT Detector Presence	4.5.36	Vsn
		Cabinet Door Open	4.5.37	CO

Table 4.2
Control and Reply Bits for either Junction or Stand–alone Facilities

Control		Description	Reply	
Designation	**Clause**		**Clause**	**Designation**
Dn (or Dx)	4.4.3	Demand Individual Stage (or Common Stages)	4.5.18	SDn (or SDx)
Fn	4.4.18	Force Stage		
FM	4.4.39	Fall Back Mode	4.5.9	FC
HI	4.4.42	Hurry Call Inhibit		
		Stage Confirmation, Stage n	4.5.5	Gn
		Hurry Call Confirmation or Request	4.5.11	HC
		Manual Control	4.5.19	MC
		Emergency Vehicle	4.5.28	EV
		Vehicle Red Signal aspect Failure Indication 1	4.5.26	RF1
		Vehicle Red Signal aspect Failure Indication 2	4.5.27	RF2

Table 4.3
Control and Reply Bits for Junction Facilities

Control		Description	Reply	
Designation	**Clause**		**Clause**	**Designation**
PV	4.4.29	Hold Vehicle Stage		
PX	4.4.30	Demand Pedestrian Stage		
		Puffin Clearance Period	4.5.14	PR
		Vehicle Green Confirm	4.5.7	GX
		Wait Indicator Confirm	4.5.12	WI

Table 4.4
Control and Reply Bits for Stand–alone Facilities

5 REFERENCES

5.1 Where undated references are listed, the latest issue of the publication shall apply.

British Standards

5.2 British Standards are published by The British Standards Institution, London,

BS 7671	Requirements for Electrical Installations (The IEE wiring regulations)
BS EN50556	Road Traffic Signal Systems
CLC/TS 50509	Use of LED Signal Heads in road traffic signal systems

Specifications

5.3 TOPAS Limited specifications are available from www.topasgroup.org.uk.

TOPAS 2500	Specification for Traffic Signal Controller.
TOPAS 2505	Specification for Above Ground Vehicle Detector Systems For Use At Permanent Traffic Signal Installations
TOPAS 2506	Specification for Above Ground On-crossing Pedestrian Detection System
TOPAS 2507	Specification for Kerbside Pedestrian Detection Systems for use at Pedestrian Crossings
TOPAS 2508	Performance Specification for Tactile equipment for use at Pedestrian Crossings
TOPAS 2509	Performance Specification for Audible Equipment for use at Pedestrian Crossings.
TOPAS 2511	Specification for Nearside Signal and Demand Unit
TOPAS 2512	Performance Specification for Below Ground Vehicle Detection Equipment
TOPAS 0600	TOPAS Registration process

Other Publications

5.4 Other publications can be obtained from the Stationary Office:

IEC 297 Dimensions of Mechanical Structures of the 482.6 mm (19”) Series

APPENDIX A TRAFFIC PROTOCOL DETAILS

This appendix defines any protocols used for interfacing traffic equipment which are either an open standard or are provided by an organisation to be used freely.

This is not an exhaustive list – other open protocols may be available for use with traffic control equipment.

UTMC-TS004.0064bis:2017	Traffic signal interface
UTMC Remote Monitoring unit MIB	UTMC Objects specification for remote monitoring of traffic controllers, pedestrian controllers & Overheight Vehicle Detection
UTMC-TS004.006:2010	UM/008 Full UTC MIB
UTMC-TS004.006:2010	UM/003 VMS MIB

APPENDIX Z - TECHNICAL FILE CONTENT

This appendix defines the necessary content for a Technical File Pack (a collection of relevant documents) which must be reviewed by an appropriate Notified Body as part of the TOPAS Registration process (See TOPAS 0600).

Only the 'ticked' items are required to be present in a Technical File Pack used to support TOPAS Registration against TOPAS 2523.

Note: Manufacturers wishing to Register products solely against TOPAS 2523 should contact TOPAS to ensure that the necessary testing and technical file content is properly considered before embarking on the Registration process.

Ref	***Item***	***Description***	***Required***
1	Technical File overview document.	A summary document outlining the product, specifying which TOPAS and other relevant specification(s) the product has been designed to comply with, together with a detailed table of contents for the Technical File Pack. Where copies of external certificates or documents are referred to these may be included within the Technical File overview document or supplied separately as part of the Technical File Pack.	√
2	QA accreditation certificate(s).	A copy of the Quality Management Registration Certificates for the organisation applying for TOPAS Product Registration.	√
3	Details of all CE markings that apply to the product.	A list of all directives complied with and how achieved. Typically this would be references to explicit CE Technical Files and certificate's, copies of which would be included in the Technical File Pack.	√
4	A functional design description of the product.	A reference to the overall System Design Documentation for the product (by document part number and issue).	√
5	Product part numbers	A list of top level assembly part numbers and their issue states including all firmware / software part numbers and issues.	√

6	Test procedures and results	A reference to all test schedules and test result documents (by document part number and issue).	√
7	Statement of compliance	A clause by clause statement of compliance against TOPAS 2523B confirming compliance and/or listing caveats or deviations.	√
8	EMC test results	A reference to EMC test performance requirements. Copies of the results of EMC testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	√
9	Optical test results	A reference to Optical tests performance requirements. Copies of the results of Optical testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	N/A
10	Environmental test results	A reference to Environmental tests performance requirements. Copies of the results of the Environmental testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	√
11	Radio Agency test results	A reference to Radio Agency tests performance requirements. Copies of the results of Radio Agency testing undertaken by an appropriately qualified independent approved test house must be included in the Technical File Pack.	N/A
12	Primary Safety Test results	For Traffic Control equipment specifically a reference to the Primary Safety Test schedule and test results by part number and issue. A copy of the test results should be included as part of the Technical File Pack.	N/A
13	Failure Mode Analysis	A reference to the product failure mode analysis requirements and results by document part number and issue.	N/A