Siemens Mobility, Traffic Solutions,
Sopers Lane,
Poole,
Dorset,
BH17 7ER

SYSTEM/PROJECT/PRODUCT: Traffic Controllers

Siemens ST950, ST900 & ST750 Statement of Compliance Against TR 2500 Issue A, November 2005 "Specification for Traffic Signal Controller"

Prepared: Paul Cox (Lead Engineer)

Keith Manston (Product Manager)

Approved: Dave Martin (Engineering Manager)

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1. Introduction

1.1 Purpose

This document is the Statement of Compliance for the Siemens ST950, ST900 and ST750 families of Traffic Controllers from Siemens Traffic Controls on the new Highways Agency "Specification for Traffic Signal Controller" numbered TR2500 and its associated specifications.

Our comments are marked as follows:

Noted:	The clause has been noted but it contains no requirements to which we need to state our controllers' compliance.
Compliant:	A requirement clause against which our controllers are compliant against the specification as written.
Clarification:	A requirement clause to which our controllers are functionally compliant, but additional information on our implementation is provided. Alternatively, these may be instances where our products satisfy what we believe to be the requirement in a different manor to that described in the text.
Query:	Requirements that we believe are either ambiguous or erroneous and where we have provided our recommendations for change and stated our implementation on that basis.

1.2 Scope

This document covers the requirement documents TR2500A and TR2523A Highways Agency Specifications, and the referenced European Specifications HD638 (BS7987:2001), EN 50556:2011 and EN 12675:2000.

Quotes from these specifications appear in grey boxes within this document, e.g.

EN12675 3.22	*safety timings – time settings that, in the event of an error, can affect the safety of the traffic signal control equipment*

This document details the Statement of Compliance for ***new products*** released by Siemens Traffic after the release of TR2500A. We note that retrospective action is not required by TR2500A and therefore existing products are not covered by this document.

It should be noted that HD638 (BS7987:2001) has been superceeded by EN 50556:2011. As the specifications are very similar, this document covers compliance of all the controller families to both specifications.

When the ST750 and ST900 controllers were first released, the active specification was HD638 (BS7987:2001).

When the ST950 controllers were first released, the active specification was EN 50556:2011.

As well as clarifications, the document contains certain detailed interpretations and corrections to TR2500 that have previously been agreed with the Highways Agency (represented by David Overton).

1.3 Related Documents

667/BB/27000/900 – Compliance Statement for ST700 and ST800 to TR2210A

667/BB/27000/902 – Comments against draft versions of TR2500.

1.4 Issue History

This document, numbered as 667/BB/32900/901, has been used as part of the Siemens Self Certification for various types of Siemens Traffic Controllers:

Issue 5	–	Statement of Compliance for the ST900 Family to TR2500A
Issue 6	–	Document updated to also cover the ST750 Family of Traffic Controllers.
Issue 7	–	Document updated to also cover the ST950 Family of Traffic Controllers and the change of specification from HD638:2001 to EN50556:2011.

2. General Comments

This section contains queries and clarifications on areas that cover several associated requirements from one or more of the specifications, for example, several related classes in HD638.

2.1 Clarification – Signals Switch-Off at Low Voltage [HD638 only]

This covers some of the issues raised by the following requirements in HD638:2001:

HD638 4.2	*4.2 Operating voltage range* *The system shall be classified according to its mains voltage range within which the Road Traffic Signal System shall work as defined by EN 12675, as follows:* *Class A1: nominal voltage –13% … +10%* *Class A2: 220 volts –20% … +15%* *The system shall not display signals which contravene EN 12675 when the supply voltage is outside the above voltage ranges.*
HD638 4.3	*4.3.1 Switch off response voltage (V_{off})* *Class B0: no automatic switch off is required* *Class B1: automatic switch off is required at nominal voltage –20%* *Class B2: automatic switch off is required at nominal voltage –25%* *4.3.2 Auxiliary state switch response voltage (V_{aux})* *Class C0: no auxiliary state is required.* *Class C1: the system switches to the auxiliary state when the supply voltage … between 4.2 and V_{off}.*
HD638 4.5	*4.5 Voltage Dip* *… Where B0 and C0 are specified, V_{off} or V_{aux} shall be taken as zero. …*
HD638 5.2.2	*5.2.2 Requirements of signal intensity for safety* *Class AF5: For signals which are required for safety to be "ON" [e.g. Red] shall be considered to be switched "ON" if the voltage on the output of the controller is greater than 50% of the full rated output voltage …*

Our interpretation of these clauses is that the controller is required to switch off the signals if the supply is below 50% of the full rated output in order to meet Class AF5 and the note in section 4.2, even though Class B0 is specified.

In our implementation in order to comply with Class AF5, the controller will extinguish the signals when the lamp supply is below a configurable threshold to reduce the possibility of unsafe signal conditions, such as dim reds. For 230V controllers for example, the controller will extinguish the signals when the bright lamp supply falls below 160V (default), so this will only extinguish the signals under exceptionally low mains supply conditions. We believe this also aligns with the new wording of clause 4.3.1 in EN50556:

EN50556 4.3.1	*Low Voltage Auxiliary state switch response voltage (V_{aux})* *It is expected that all controllers will have a point where low input supply voltage will mean that the monitoring systems employed may be unable to operate and therefore would be unable to guarantee the detection or prevention of signal states which endanger traffic. The controller shall be prevented from reaching this limit and should switch to a safe state (Note 1), in a controlled manner before this point is reached.*

2.2 Query – Signals States Endangering Traffic

This query covers some of the issues raised by the following requirements:

HD638 & EN50556 3.1.2	*Failure Mode Analysis – means of examining all failure modes to ensure that signal states endangering the road users …*
HD638 & EN50556 3.1.3	*Signal Safeguarding Facility – facilities intended to prevent states of signals endangering the traffic.*
HD638 & EN50556 5.2.3	*5.2.3 Requirements for signal states* *5.2.3.1* ***Signal states which endanger traffic shall be prevented*** *during operation of a Road Traffic Signal System* ***as described in 5.2.3.4****. When a system is installed and operated …* *5.2.3.2 Failures shall be primarily prevented by formal measures of quality assurance in development and manufacturing as well as by correct installation. This shall be achieved by EN ISO 9001 or equivalent…* *5.2.3.3 If a failure could lead to a* ***signal state endangering the traffic as defined in EN 12675,*** *a* ***functionally independent safeguarding facility*** *shall lead to a safe signal state of operation as defined in EN 12675. This safeguarding facility shall become active within a time interval specified according to the following classes:* *Class AG1: 100ms, Class AG2: 150ms, Class AG3: 200ms, Class AG4: 300ms,* ***Class AG5: 500ms,*** *Class AG6: 800ms, Class AG7: 850ms, Class AG8: 1000ms* *NOTE: This time interval is the time from the dangerous signal occurs until this state has been removed.* *5.2.3.4 To ensure that the requirements … one of the following procedures shall be carried out …* *Class X1: Both a failure mode analysis according to 5.2.4 and functional tests according to clause 6 shall be carried out in accordance with signal states dangerous to traffic specified in EN 12675.* *Class X2: Functional tests according to clause 6. Subclause 5.2.4 is not mandatory.*
EN50556 5.2.3.4	*(Each country should clearly specify their requirements as to what "signal states dangerous to traffic" are, by defining their selection from EN 12675.)*
EN12675 3.6	*failure mode – non-operational state of the traffic signal controller in which, as a result of a major fault, the normal operation mode is replaced with a flashing yellow or a signals off condition.*
EN12675 3.8	*major fault – fault the occurrences of which has the effect that the safe operation of the signal traffic system cannot be guaranteed as defined in the national requirements.*
EN12675 5.2	*A major fault shall cause the traffic signal controller to change to the failure mode.*
EN12675 5.3	*A minor fault shall not cause the traffic signal controller to change to the failure mode…* *A minor fault may influence the duration and sequence of signal groups.* *A minor fault shall not affect the safe operation of the intersection.*
TR2500 3.16	*3.16 Major faults are defined as those described in the following classes of BS EN 12675.* *AA1 [Green-Green Conflict]; AB1 [Green-Yellow Conflict]; AD1 [Green-Red/Yellow Conflict]; DA1 [Compliance Checking]; FA1* [Timing Corruption]* *3.17 Other faults are defined as minor faults.* *3.18 The Works Specification may require certain other faults to cause the controller to switch off.* *3.19 In the event of a major fault, the failure mode shall be "all signals off" including non-operation of "wait" and demand indicators and tactile and audible devices.*

* See our comments against Class FA1 on page 23.

2.2.1 Signal States that Endanger Traffic and Class X1

In HD638 section 5.2.3.3 it says: *"a signal state endangering the traffic as defined in EN12675"* but EN12675 does not use the same phrase and therefore, it could be implied that ***all*** fault classes in EN12675 could lead to a signal state that endangers traffic. However, since EN12675 5.3 clearly states that *"a minor fault shall not affect the safe operation of the intersection"*, it is assumed that only Major Faults are really signal states that endanger traffic, and this is confirmed by the wording in EN50556 section 5.2.3.4.

The classes that identify the signal states that endanger traffic are therefore assumed to be those listed as 'Major Faults' in TR2500; when those signal states occur, the controller is to enter failure mode. However, this still does not clearly identify those signal states / classes that require the application of 'Failure Mode Analysis'. We believe TR2500 Clause 3.16 ***must*** explicitly state which classes require the application of 'Failure Mode Analysis'.

The following was agreed with David Overton (HA Representative) on 26/27 April 2006:

- We agreed that 'signal states endangering traffic' and 'Major fault' are the same.
- Add to 3.16: "All these Major Faults require the application of Class X1 of BS7987 (HD638)" or similar words to clarify when Class X1 should be applied.
- Remove Class FA1 (timing corruptions) from this list of Major Faults.

Our implementation is therefore that all the Major Faults identified in clause 3.16 of TR2500A, with the exception of Class FA1, require the application of Class X1 and thus will be checked as part of our self-certification documentation using the 'Failure Mode Analysis' process described. Therefore we consider the Major Faults are: Class AA1 [Green-Green Conflict]; Class AB1 [Green-Yellow Conflict]; Class AD1 [Green-Red/Yellow Conflict]; Class DA1 [Compliance Checking].

2.2.2 Major / Minor Faults

Since EN12675 5.3 clearly states that *"a minor fault shall not affect the safe operation of the intersection"*, it is implied that minor faults are not 'signal states that endanger traffic'.

Given that TR2500 clause 3.16 identifies the Major Faults our interpretation is that all other faults including some listed as classes in EN12675 are Minor Faults, which includes Red Lamp Monitoring classes for example. Our interpretation is that Minor Faults do not require the application of 'Failure Mode Analysis' as requested by Class X1.

2.2.3 Functional Independent Safeguarding Facility

It is also not clear what is meant by a 'functional independent safeguarding facility'. How 'independent' does the signal safeguarding facility have to be, and does it only apply when 'Failure Mode Analysis' is required?

Our interpretation is that a monitoring facility must be provided to check for the faults identified, but this does not need separate hardware or a separate microprocessor for example. Such a facility is functionally independent in that it is not concerned with the control and switching of the traffic signals, but is purely concerned with providing the monitoring function. Only when Failure Mode Analysis is required do physically independent monitoring devices and processors for example reduce or eliminate the risk of not detecting the signal state that endangers traffic due to a failure within the controller.

2.3 Query – Safety Data / Safety Timings

This query covers some of the issues raised by the following requirements:

TR2500 K7	*Level 2 – Access is for modifying non safety data … by local handset or remote access. …*
TR2500 K8	*Level 3 – Access is for modifying safety data …*
TR2500 K9	*Level 4 – Access to data appertaining to Traffic Safety Data (BS 7987 3.2.5.2) (site configuration parameters) shall not be changeable on-site or via levels 1, 2 or 3'.*
HD638 & EN50556 3.2.5	*Traffic Data – that data which specifies how the application program will perform in the particular circumstances of one traffic system. This may be considered to be in 2 parts:* *Traffic Safety Data – is all Traffic Data stored in non-volatile memory that has a direct impact on the safety of road users* *Traffic Non Safety Data – all the remainder of the data which will not cause an unacceptable danger to the road user if the data is changed* (The implication is then that Traffic Safety Data is 'fixed', and non-safety data is 'modifiable')
EN12675 3.22	*safety timings – time settings that, in the event of an error, can affect the safety of the traffic signal control equipment*
EN12675 4.9	*4.9 Safety Timings* *The traffic signal controller shall check that the values of safety timings are in accordance with national requirements for the following classes:* *a) Stored values of timings* *Class FA0: There is no requirement to check for stored values of timings not being correct.* *Class FA1: The stored values of timings shall be checked. The check shall ensure that the stored values are not corrupted. In the event of an error, the traffic signal controller shall register a fault.*

The definitions of 'Safety Timings' and 'Safety Data' do not seem consistent:

Firstly, it is confusing that the descriptions of level 2 and 3 items in K7 and K8 use the phrase 'safety data' when 'traffic safety data' is used for level 4 items in K9. We recommend that the phrase 'safety timings' (same as Class FA1) be used in K7 and K8, rather than 'safety data'.

Secondly, phrases such as 'safety timings' and 'safety periods' are used in several appendices of TR2500 where we believe they are referring to minimum green, intergreen, amber leaving and red/amber times for example, which include ***level 3 and level 4*** timings. We recommend that K9 be modified to read 'Access to safety timings and Traffic Safety Data…'.

Thirdly, there is no definition of what timings are considered 'safety timings' in TR2500. The recommended changes above to K8 and K9 would help as they now state that 'safety timings' include the level 3 and level 4 timings in the tables.

Our interpretation is therefore as follows. 'Safety timings', 'safety periods' and 'safety data' includes for example minimum green, intergreen, amber leaving and red/amber times, i.e. level 3 and level 4 items, whereas 'Traffic Safety Data' covers only level 4 items. In our implementation all timings will be checksum protected in two separate areas, with timings assigned to access levels 2 and 3 (modifiable) kept separate from level 4 timings (fixed data).

2.4 Query – Compliance Checking

This query covers some of the issues raised by the following requirements:

HD638 5.2.2 Class AF5	*5.2.2 Requirements of signal intensity for safety – Class AF5:* *For signals which are required for safety to be **"ON" [e.g. Red]** shall be considered to be switched "ON" if **[1a]** the voltage on the output of the controller is greater than 50% of the full rated output voltage **and [2a]** the current is greater than 10 mA per signal head.* *For signals which are required for safety to be **"OFF" [e.g. Green]** shall be considered to be switched off if **[3]** the voltage on the output of the controller is less than 20% of the full rated output voltage.*
EN50556 5.2.2 Class AF5	*5.2.2 Requirements of signal intensity for safety – Class AF5:* *For signals which are required for safety to be **"ON" [e.g. Red]** and for which monitoring of absence is required, signals shall be considered to be switched "ON" if **[1b]** the voltage on the output of the controller is greater than minimum switch on voltage for the class of signals defined as compatible.* ***[2b]** In addition a method of confirming that the signals are drawing power (i.e. there is something connected) shall also be provided. This may be either monitoring of the current consumed by the signals or other similar technique. Any such technique shall consider the environmental effects on measurements and this should be demonstrated in the technical assessment of the technique.* *For signals which are required for safety to be **"OFF" [e.g. Green]** shall be considered to be switched off if **[3]** the voltage on the output of the controller is less than 20 % of the full rated output voltage.*
EN12675 4.8 Class DA1	*4.8 Compliance checking* *The traffic signal controller shall ensure that the state of the signals is in accordance with the commands given by the traffic signal controller logic. Compliance is ensured if, and only if, the state of the signals is in accordance with the command given.* *Class DA0: There is no requirement to check for compliance.* *Class DA1: **[4]** Lack of compliance exceeding a time interval for the requirements for signalling specified in HD638 shall register a fault.*

Our interpretation is that it is not intention of these clauses to insist on different voltage thresholds depending on whether the controller output is connected to signal that are required to be "ON" or "OFF" for safety, in effect different voltage thresholds on Red and Green controller outputs, although these may be provided as an alternative solution.

Our interpretation of these clauses is as follows:

2.4.1 Voltage Monitoring for 'Red' Outputs

[1a] HD638: *"For signals which are required for safety to be "ON" shall be considered to be switched "ON" if the voltage on the output of the controller is greater than 50% of the full rated output voltage"*

[1b] EN50556: *"For signals which are required for safety to be "ON" and for which monitoring of absence is required, signals shall be considered to be switched "ON" if the voltage on the output of the controller is greater than minimum switch on voltage for the class of signals defined as compatible"*

In our implementation, we check that the voltage at the (red) signal aspect output by checking the overall lamp supply voltage **and** checking each output switch is "ON". The lamp supply is checked against configurable thresholds, depending on the controller type. The output switches are checked using the 20% thresholds; see section 2.4.4 below. We believe there is no reasonable way that the overall lamp supply could be above the configured lamp supply threshold and the output switch appears on, but the voltage at the (red) output is too low.

2.4.2 Current Monitoring for 'Red' Outputs

[2a] HD638: *"the current is greater than 10 mA per signal head"*

[2b] EN50556: *"In addition a method of confirming that the signals are drawing power (i.e. there is something connected) shall also be provided. This may be either monitoring of the current consumed by the signals or other similar technique. Any such technique shall consider the environmental effects on measurements and this should be demonstrated in the technical assessment of the technique."*

Our interpretation of this is that the requirement for monitoring the current of signals that are required for safety to be “ON” is covered separately by the Red Lamp Monitoring requirements in TR2500, which is Minor Fault (see section 2.2.2), and can be ignored by Class DA1 (Compliance Checking). The controller is only required to monitor the ***voltage*** on each of its outputs to check for Class DA1, which is Major Fault.

In our implementation of Red Lamp Monitoring, where we monitor a number of signal heads driven from a single controller output, we detect first and second red lamp failures as required by TR2500. In this sense, the 10mA requirement in HD638 [see 2a above] is redundant because signals generally consume much more than 10mA. Indeed, this figure is not present in EN50556 and the clause has been reworded [see 2b above]. In addition, we wish to make it clear that current monitoring of several signal heads connected to a single controller output is inherently difficult, particularly with the introduction of LED Signals, and therefore we can only monitor certain types of signal.

2.4.3 Voltage Monitoring for ‘Green’ Outputs

[3] *“the voltage on the output of the controller is less than 20% of the full rated output voltage”*

We note that there does not appear to be a definition for the phrase ‘full rated output voltage’. For the purposes of this clause, we have assumed this refers to the nominal Bright lamp supply voltage.

Our interpretation of this part of the class is that the controller must monitor each output provided by the controller. It must register a fault when a voltage of 46V RMS or higher is detected for 230V rated outputs. For outputs designed to power the signals at Extra Low Voltages, the threshold is lower, e.g. 9.6V for 48V.

2.4.4 Class DA1: Compliance Monitoring

[4] *“Lack of compliance … shall register a fault”*

Our interpretation of this is that, as a minimum, each output of the controller only needs one threshold designed to detect <20% of the full rated output. Each individual output will be confirmed as ‘OFF’ if the voltage is less than the 20% threshold as required. An individual output will be confirmed as ‘ON’ if the voltage is greater than this same threshold. This state will then be checked against the commands from the ‘logic’ to check for compliance and discrepancies will be treated as a Major Fault.

As detailed in the points above, the controller will also monitor the overall lamp supply voltage and currents of specified red signals to try to ensure that the red signals are illuminated and treat missing reds as Minor Faults, as per the requirements for Red Lamp Monitoring in TR2500.

2.5 Clarification – ST950 Reserve State

The ST950 family of controllers include a feature that allows configuration and software updates to be performed on the traffic signal controller while the traffic signals remain illuminated, thus reducing the impact on the traffic during such maintenance.

The controller includes a configurable ‘reserve’ state that permits the user to update the configuration and even the software in the application processor, while separate microcontrollers continue to provide safe operation of the traffic signals during the brief period that the application processor is unavailable (typically less than one minute).

During this state, all the microcontrollers responsible for the checks that prevent signals states endangering traffic continue to operate normally.

In this reserve state, the modes of operation are limited to Fixed Time operation (TR2500 Appendix A) and Part Time operation (TR2500 Appendix D). If the controller were running a different mode of operation such as CLF, the controller naturally reverts to Fixed Time mode of operation while the application processor is unavailable, and then resumes CLF operation when it returns. For controllers with pedestrian facilities (TR2500 Appendix J), the pedestrian signals remain at red during this state.

If the application processor fails to return to normal operation within a configurable period, further configuration options specify whether the signals continue as above or extinguish (or flash for non-UK installations).

3. Compliance against BS7987 (HD638) and EN50556

This section contains comments against the clauses in HD638 S1 / BS7987:2001, and its successor EN50556:2011, containing the requirements for “Road Traffic Signal Systems”…

HD638 / EN50556	Compliance	Comment
		HD638/EN50556 Section 1 – Scope
1.	Noted	
		HD638/EN50556 Section 2 – Normative References
2.	Noted	
		HD638/EN50556 Section 3 – Definitions
3.	Noted	
		HD638/EN50556 Section 4 – Electrical Supply and Limits
4.1	Noted	
4.2 Class A1	Compliant	*4.1 Nominal voltages* *The standard nominal voltage for connection to the public supply shall be taken to be 230V AC RMS. Other nominal voltages shall be permitted.* *4.2 Operating voltage range* *The system shall be classified according to its mains voltage range within which the Road Traffic Signal System shall work as defined by EN 12675, as follows:* ***Class A1: nominal voltage –13% … +10%*** *Class A2: 220 volts –20% … +15%* *The system shall not display signals which contravene EN 12675 when the supply voltage is outside the above voltage ranges.* Our controllers are actually designed to operate over a wider voltage range than the 230V –13% to +10% specified here. See also our comments against clauses 4.3.1 and 4.3.2 of HD638 which follow. We note that the Classes A1 and A2 do not appear in EN50556, and Class A1 has effectively been made mandatory.
HD638 4.3.1 Class B0	Clarification	*Switch off response voltage (V_{off})* *The system shall be classified as follows according to whether or not it automatically switches off when the supply voltage falls below a specified value.* ***Class B0: no automatic switch off is required*** *Class B1: automatic switch off is required at nominal voltage –20%* *Class B2: automatic switch off is required at nominal voltage –25%* Clause only present in HD638. See our General Clarification #2.1 on page 5.
HD638 4.3.2 Class C0	Noted	*Low Voltage Auxiliary state switch response voltage (V_{aux})* *The auxiliary state is a state specified by the customer which will occur when normal operation is not satisfactory due to low supply voltage or other specified conditions. This state shall be specified by EN 12675 as Signals off or Flashing Yellow, etc.* *The system shall be classified as follows according to whether or not the system automatically switches to an auxiliary state when the supply voltage falls below a specified value (V_{aux}).* ***Class C0: no auxiliary state is required;*** *Class C1: the system switches to the auxiliary state when the supply voltage has any value between the minimum operating voltage as specified in 4.2 and V_{off}.* Note: This wording is only present in HD638. We note that there is no requirement in TR2500 to enter an auxiliary state when the supply is below –13%.

HD638 / EN50556	Compliance	Comment
EN50556 4.3.1	Compliant	*Low Voltage Auxiliary state switch response voltage (Vaux)* *It is expected that all controllers will have a point where low input supply voltage will mean that the monitoring systems employed may be unable to operate and therefore would be unable to guarantee the detection or prevention of signal states which endanger traffic. The controller shall be prevented from reaching this limit and should switch to a safe state (Note 1), in a controlled manner before this point is reached.* *In a controlled manner means that it shall shut down in such a way as to prevent any likelihood of a hazardous signal state being displayed during the process of switching to the safe state.* *Note 1: The safe state noted above may either be all signals off or a flashing display of either red or yellow or a combination of red and yellow, which is recognised in the country in which the controller is to be used as a safe state, warning users to proceed carefully / give way to others.* Note: This wording is only present in EN50556. Despite this, all our controllers are compliant with this requirement. Note: As required by the following clause, when the supply voltage rises recovery is automatic by default; the use of the phrase 'shut down' in clause 4.3.1 above could be confusing.
HD638 4.3.3 EN50556 4.3.2	Compliant	*Power up activation voltage* *The system shall become active when the supply voltage reaches a value within its operating voltage range. The restart procedure shall normally be automatic or in exceptional circumstances it may be by manual or remote control. No signalling state dangerous to traffic shall be possible and the signalling state shall conform to EN 12675.* (Note section numbering different between HD638 and EN50556, but text identical)
4.4 Class D0	Noted	*Class D0: No overvoltage protection device is required.*
HD638 4.5 Class E2	Clarification	*4.5 Voltage Dip* *The system shall be classified according to the duration of dips in supply which affect the operation. In order to avoid undesirable reactions by the signal safeguarding facilities, the system shall operate as shown in Table 1 according to the duration of the voltage dip below V_{off} or V_{aux}.* ***Where B0 and C0 are specified, V_{off} or V_{aux} shall be taken as zero.*** *Period t1 is a timeperiod of a voltage dip in the supply which will not affect the normal operation of the system. Period t2 is a timeperiod of voltage dip in the supply when the system shall change to signals OFF followed by the start-up sequence.* Criterion / Class E1 / **Class E2** / Class E3 Period t1: < 50ms / **< 20ms** / < 20ms Period t2: > 300ms / **> 800ms** / > 100ms *For any voltage dip in the supply between t1 and t2 the controller may remain working correctly or change to signals OFF followed by the start up sequence.* Compliant as written except, as noted in our General Clarification #2.1 on page 5, we implement a configurable V_{off} threshold even though Class B0 is specified.
EN50556 4.5 Class E3	Compliant	*4.5 Voltage Dip* *The system shall be classified according to the duration of dips in supply which affect the operation. In order to avoid undesirable reactions by the signal safeguarding facilities, the system shall operate as shown in Table 1 according to the duration of the voltage dip below V_{aux}.* *Period t1 is a timeperiod of a voltage dip in the supply which will not affect the normal operation of the system. Period t2 is a timeperiod of voltage dip in the supply when the system shall change to signals OFF followed by the start-up sequence.* Criterion / Class E3 Period t1: < 20ms Period t2: > 100ms *For any voltage dip in the supply between t1 and t2 the controller may remain working correctly or change to signals OFF followed by the start up sequence.* We note that the Class E2 requested by TR2500A is not present in EN50556, leaving only the more strict Class E3. All our controllers meet both Class E2 and Class E3; the signal sequence restarts when dips >100mS are detected.

HD638 / EN50556	Compliance	Comment
4.6 Class F2	Compliant	*4.6 Mains Frequency* *The system shall be classified as follows according to the acceptable variations in mains frequency.* *Class F1: 50 Hz ±2%* ***Class F2: 50 Hz ±4%*** *Class F3: 50 Hz ±10%* *Class F4: 60 Hz ±2%* Our controllers may be designed to operate with supplies in the range 48Hz to 52Hz and 57Hz to 63Hz, which exceeds the requirement Class F2. We note that only Class F2 exists in EN50556.
HD638 4.7	Noted	*4.7 Detectors* *The detectors may be powered from a separate supply or from the controller. The recommended voltages are:* *The operating voltage (see 4.2), 110V AC, 24V AC, 24V DC, 12V DC* Since this clause only lists the 'recommended voltages', we would continue to power detectors as detailed in TR2523. We note that this section does not exist in EN50556.
		HD638 Section 5.1 – Electrical Safety
HD638 5.1	-	Note that the wording and section numbering within section 5.1 differs significantly between HD638 and EN50556. These are the comments against section 5.1 in HD638…
HD638 5.1.1	Clarification	*The Road Traffic Signal System shall conform to HD384.4. This subclause deals with the additional requirements for Road Traffic Signal Systems* Our understanding is that conforming to BS7671 (IEE Wiring Regulations) meets this requirement.
HD638 5.1.1.1.1 Class T2	Compliant	*Leakage Current – Road Traffic Signal Systems* *Class T1: For Road Traffic Signal Systems, leakage current protection facilities confirming to HD 384.4.41 shall be fitted. Earth leakage circuit breakers conforming to EN 61008 for nominal currents 20% greater than the expected current and nominal leakage currents ≤ 0.3 A shall be installed.* ***Class T2:** No requirement for leakage current protection facilities for the whole system, however the customer may request facilities as class T1.*
HD638 5.1.1.1.2 Class U1	Compliant	*Maintenance equipment supply*
HD638 5.1.1.2	Compliant	*Earthing*
HD638 5.1.1.2.1	Compliant	*Protective earth conductor (PE)*
HD638 5.1.1.2.2 Class L1	Compliant	*PE wiring of external equipment*
HD638 5.1.1.2.3 Class M1	Compliant	*Accepted methods of earthing*

HD638 / EN50556	Compliance	Comment
HD638 5.1.1.3 Class V4	Compliant	*Enclosure* *The enclosure shall provide the mechanical protection to IK07 (see EN 50102) with the following criteria:* *No damage shall occur to the equipment contained within the enclosure and the equipment shall continue to operate to it's specification. There shall be no degradation of the IP rating of the equipment.* *Class V1: Enclosures shall provide protection to IP44. When the manual panel is open, the protection provided shall be to IP42. When the enclosure is open the protection shall be to IP20.* *Class V2: Enclosures shall provide protection to IP54. When the manual panel is open, the protection provided shall be to IP43. When the enclosure is open the protection shall be to IP23.* *Class V3: Enclosures shall provide protection to IP44. When the enclosure is open the protection shall be to IP21.* ***Class V4:** Enclosures shall provide protection to IP55. When the manual panel is open, the protection provided shall be to IP43. When the enclosure is open the protection shall be to IP20.*
HD638 5.1.1.4	Compliant	*Access*
HD638 5.1.1.5	Compliant	*Over-current protection*
HD638 5.1.1.6 Class H0	Noted	*Terminations*
HD638 5.1.1.7 Class J2	Noted	*Controller enclosure doors* *The controller enclosure shall be classified according to whether or not it is fitted with a device to lock the doors in the open position as follows:* *Class J0: No open locking device provided.* *Class J1: Inspection doors shall be provided with an open locking device or simple unhinging mechanism. The doors shall not be capable of being unhinged in the closed position.* ***Class J2:** No open locking device provided, but the purchaser may specify the device.*
HD638 5.1.2 Class K1	Clarification	*Controller Signal Outputs* ***Class K1:** 0.1A to 4A* *Class K2: 0.09A to 2.0A* *Class K3: 0.07A to 5A at power factor > 0.8* *Class K4: 30 VA up to 1200 VA* Our Low Voltage (230V) Controllers will meet or exceed this class. Our Extra Low Voltage (48V) Controllers may only provide 2A per output at 48V for Low Power LED Signals. In this case, our intersection controllers allow multiple outputs to be configured for one phase aspect to achieve and indeed exceed this class if required by the Works Specification. Since stand-alone pedestrian crossings are unlikely to require more than 2A (e.g. eight 12W signals) per phase aspect, our dedicated smaller single and dual pedestrian controllers may be limited to 2A per phase aspect.
HD638 5.1.3	Noted	*Signal heads*
HD638 5.1.4	Noted	*Detectors and push buttons*
HD638 5.1.5	Compliant	*Interconnections*
HD638 5.1.6.1	Compliant	*PE cable dimensions*
HD638 5.1.6.2	Clarification	*Earth cable dimensions* The incoming Earth cable complies with the electrical supply regulations in the UK.

HD638 / EN50556	Compliance	Comment
HD638 5.1.6.3	Compliant	*Distribution cables*
		EN50556 Section 5.1 – Electrical Safety
EN50556 5.1	-	Note that the wording and section numbering within section 5.1 differs significantly between HD638 and EN50556. These are the comments against section 5.1 in EN50556…
EN50556 5.1.1.1	Clarification	*The Road Traffic Signal System shall conform to HD384.4. This subclause deals with the additional requirements for Road Traffic Signal Systems* Our understanding is that conforming to BS7671 (IEE Wiring Regulations) meets this requirement.
EN50556 5.1.1.2.1 Class T2	Compliant	*Leakage Current – Road Traffic Signal Systems* *Class T1: For Road Traffic Signal Systems, leakage current protection facilities confirming to HD 384.4.41 shall be fitted. Earth leakage circuit breakers conforming to EN 61008 for nominal currents 20% greater than the expected current and nominal leakage currents ≤ 0.3 A shall be installed.* ***Class T2:** No requirement for leakage current protection facilities for the whole system, however the customer may request facilities as class T1.*
EN50556 5.1.1.2.2 Class U1	Compliant	*Maintenance equipment supply* *To conform with HD 60364-4-41, an earth leakage circuit breaker conforming to EN 61008 series with nominal leakage currents ≤ 0,03 A shall be installed.* We note that Classes U0 and U1 do not exist in EN50556, effectively making Class U1 requested by TR2500A mandatory.
EN50556 5.1.1.3.1	Compliant	*Earthing – General*
EN50556 5.1.1.3.2	Compliant	*Protective earth conductor (PE)*
EN50556 5.1.1.3.3 Class L1	Compliant	*PE wiring of external equipment* We note that in EN50556, the wording has been changed and Classes L0 and L2 do not exist, making Class L1 mandatory.
EN50556 5.1.1.4 Class V4	Compliant	*Enclosure* *The enclosure shall provide the mechanical protection to IK07 (see EN 50102) with the following criteria:* *No damage shall occur to the equipment contained within the enclosure and the equipment shall continue to operate to it's specification. There shall be no degradation of the IP rating of the equipment.* *Class V1: Enclosures shall provide protection to IP44. When the manual panel is open, the protection provided shall be to IP42. When the enclosure is open the protection shall be to IP20.* *Class V2: Enclosures shall provide protection to IP54. When the manual panel is open, the protection provided shall be to IP23. When the enclosure is open the protection shall be to IP21.* We note that Class V4 from HD638 (see page 15) requested by TR2500A does not exist in EN50556: "Enclosures shall provide protection to IP55. When the manual panel is open, the protection provided shall be to IP43. When the enclosure is open the protection shall be to IP20." The controller cabinet meets Class V1 and Class V2.
EN50556 5.1.1.5	Compliant	*Access*
EN50556 5.1.1.6	Compliant	*Over-current protection*
EN50556 5.1.1.7 Class H0	Noted	*Terminations*

HD638 / EN50556	Compliance	Comment
EN50556 5.1.2 (Class K1)	Compliant	*Controller Signal Outputs* *The controller shall provide electrical power to the signals (as described in EN 12368), and the signals shall use this power. Electrical details of compatible signal heads shall be specified by the controller manufacturer in order to ensure the safety of the system. This should list either those signals know to be compatible or the class of signals to EN 12368 or CLC/TS 50509 that would by definition make them compatible with the control systems required monitoring performance and prevention of hazardous displays.* We note that Classes K1-K4 do not exist in EN50556.
EN50556 5.1.3	Compliant	*Interconnections*
EN50556 5.1.4.1	Compliant	*Cables – PE cable dimensions*
EN50556 5.1.4.2	Clarification	*Cables – Earth cable dimensions* The incoming Earth cable complies with the electrical supply regulations in the UK.
EN50556 5.1.4.3	Compliant	*Cables – Distribution cables*
EN50556 5.1.5.1	Compliant	*Insulation – Isolated circuits*
EN50556 5.1.5.2	Compliant	*Insulation – Linked circuits*
EN50556 5.1.5.3	Compliant	*Insulation paths*
EN50556 5.1.5.4	Compliant	*Insulated devices*
		HD638/EN50556 Section 5.2 – Traffic Safety
5.2.1	Noted	
5.2.2 Class AF5	Clarification	*5.2.2 Requirements of signal intensity for safety – Class AF5:* See our General Query #2.4 on page 9.
5.2.3.1	Compliant	
5.2.3.2	Compliant	
5.2.3.3 Class AG5	Compliant	Our controllers are compliant, but see our General Query #2.2 on page 6 for comments on what constitutes a signal state endangering the traffic.
5.2.3.4 Class X1	Query	See our General Query #2.2 on page 6.
5.2.3.5	Clarification	*The signal safeguarding facility shall always be active as long as the Controller is powered.* Our interpretation of the specifications is that it is acceptable that a signal safeguarding facility is permitted to be inactive once the controller has entered failure mode, since the safeguarding facility can do no more at that point.
5.2.4	Compliant	
HD638 5.2.5.1 EN50556 5.2.5.2 Class N0	Noted	*Location of monitoring elements for detection of absent signals.* Class N0 is requested by TR2500: No requirements on the location of monitoring elements above that required by Class X1 (Failure Mode Analysis). We also note that Class AF5 requires monitoring of the voltage at the controller outputs.
HD638 5.2.5.2 Class P0	Noted	*Location of monitoring elements for detection of unwanted displays.* Class P0 is requested by TR2500: No requirements on the location of monitoring elements above that required by Class X1 (Failure Mode Analysis). We also note that Class AF5 requires monitoring of the voltage at the controller outputs. We note that this clause is not present in EN50556.

HD638 / EN50556	Compliance	Comment
EN50556 5.2.5.3	Compliant	***Performance of monitoring elements for detection of unwanted displays*** *The system shall be tested to certify the performance of monitoring elements which are fitted for the detection of unwanted displays, e.g. greens as follows:* *It is considered that the most important function of the safety system is to monitor for and prevent unwanted displays, which could be hazardous to users. Therefore it is required that this monitoring and the associated circuits are both analysed and tested to ensure that under all reasonably practicable circumstances, such signal states are prevented. Furthermore that any faults in the system that might prevent hazardous signal states being identified are also detected and acted upon. Thus for these circuits Class X1 according to 5.2.3.4 and 5.2.4 is required.* We note that this clause is not present in HD638. However, all our controllers comply with this clause.
		HD638/EN50556 Section 6 – Testing
6.1	Noted	
6.2	Noted	
6.3.1	Compliant	
6.3.2	Compliant	*Random vibration test* See also our comments against Classes AJ2, AMn and AL2 on starting on page 20.
6.3.3.1	Noted	
6.3.3.2	Compliant	*Impact for equipment enclosures*
6.3.4	Compliant	*Degree of protection*
6.3.5	Compliant	*Dry heat (Class AB3)*
6.3.6	Compliant	*Cold (Class AE2)*
6.3.7	Compliant	*Damp heat (Class AK2)*
6.3.8	Noted	*Solar radiation (Class AH0 – No test)*
6.4	Compliant	
6.5	Compliant	
6.6	Compliant	
6.7	Compliant	
		HD638/EN50556 Section 7 – Electrical Interfaces
7	Compliant	
		HD638/EN50556 Section 8 – Installation
8.1	Clarification	*…* *The location of the equipment on site shall take into account all safety aspects throughout its life. This shall cover all aspects including manual operation of the signals and maintenance operation, e.g. doors shall not open into the carriageway.* *…* Where we are not responsible for the junction design, we cannot be held responsible for the location of the equipment.
8.2	Compliant	
8.3	Clarification	*8.3 Test of cable following the installation of cables* *Normally individual tests on cables are not required to be carried out at the time of installation and before termination. These cables are tested together with all the system equipment as described in 8.6 prior to application of the mains supply.* The customer may explicitly require testing of the cables prior to installation of the controller.
8.4	Compliant	
8.5.1	Compliant	

HD638 / EN50556	Compliance	Comment
8.5.2	Compliant	
8.5.3 Class AA1	Compliant	
8.6 Class R1	Compliant	We note that effectively Class R1 is now the mandatory requirement and Class R2 does not exist in EN50556.
8.7 Class S2	Compliant	We note that effectively Class S2 is now the mandatory requirement and Class S1 does not exist in EN50556
8.8	Compliant	
8.9	Clarification	*8.9 Voltage and polarity of supply* *A test shall be performed to verify that the controller is connected to the line and neutral in the correct sense. With a voltmeter measure between the following points:* *phase to neutral, phase to earth, neutral to earth* *And record the results.* We wish to make it clear that this test will not detect if the supply has been reversed before the cabinet. Since earth and neutral are often connected together prior to the cabinet, this test will not detect whether live and neutral/earth have been reversed.
8.10	Compliant	
8.11	Compliant	
8.12	Compliant	
		HD638/EN50556 Section 9 – Maintenance
9.1	Noted	
9.2	Noted	
9.3	Clarification	*9.3 Documentation required for maintenance* *The technical documents shall include literature provided by the equipment manufacturers and technical details of the installation. …* *The manufacturers shall provide the following documentation:* *- user manuals, wiring diagrams of the elements being maintained, …* *The following installation documents are required:* *- area plan indicating the site to be maintained, functional diagrams, installation diagrams, wiring diagrams, parts list, maintenance log* It is not clear who is responsible for providing the installation documents. Our interpretation is that it will normally be provided by the customer.
9.4	Noted	
9.5	Clarification	*9.5 Safety testing procedures* *The following is a list of tests and procedures which may be required for maintenance. They are not exhaustive and additional or a subset of these may be recommended by the manufacturer. Maintenance procedures which are necessary to ensure safety shall be recommended by the equipment manufacturer.* *- Test of signal timings relevant to safety* It is unclear as to exactly what is to be checked. Our interpretation is that this test is not required to be undertaken by the maintenance engineer during maintenance. For example, it is not usually the case that the maintenance personnel are sufficiently trained to be able to examine the configured timings such as minimum green and intergreen in order to determine if they are 'safe'. We also do not believe it is necessary for the maintenance engineer to confirm that the controller is obeying the configured timings.
9.6 Class Y1	Noted	
		HD638/EN50556 Section 10 – Marking and Labelling
10	Compliant	

HD638 / EN50556	Compliance	Comment
		HD638/EN50556 Section 11 – Environmental Test Conditions
Class AB3	Compliant	*Dry Heat – Class AB3: 60°C*
Class AE2	Compliant	*Cold – Class AE2: -15°C*
-	Noted	*Change of Temperature – To above classes* The above Hot and Cold tests are performed instead, as allowed.
Class AK2	Compliant	*Damp Heat – Class AK2: 2 Cycles*
Class AH0	Noted	*Solar Radiation – Class AH0: No test required*
(IP Rating)	Compliant	*Water Penetration – to required IP rating*
HD638 Class AJ2	Query	*Random Vibration – Class AJ2: 2 hours* We note that the Random Vibration classes AJ*n* only exist in HD638 and have been replaced by new classes AM*n* and AL*n* in EN50556. The levels described in HD638 are for a Transportation test as they are identical to those described in Transportation tests in TR2130B (3.11) and EN50556:2011 (Class AM*n*), but an Operational test is implied by the wording in clause 6.3.2 (page 18). We have therefore tested to the more realistic Operational Random Vibration Test as defined in TR2130B (section 3.14) and EN50556:2011 Class AL2, which replicates what the equipment will experience in real life.
(EMC)	Compliant	*EMC Test as specified in 6.7* [i.e. EN 50293]
(IK07)	Compliant	*Impact for Equipment Enclosure – IK07*
HD638 Class AC_N	Noted	*Impact for Signal Heads* This is not a requirement on the Traffic Controller itself and this clause does not exist in EN50556.
EN50556 Class AM*n*	Noted	*Class AM*n*: Random Vibration (Transportation and Operational)* As noted in our comments against HD638 Class AJ2 above, a transportation test is not required.
EN50556 Class AL2	Compliant	*Class AL2: Random Vibration (Operational)* We note that these levels are the same as those for the Operational Random Vibration Test defined in TR2130B section 3.14.
		End of HD638 / EN50556

4. Compliance against EN12675

This section contains comments against the clauses in BS EN 12675:2001 “Traffic Signal Controllers – Functional Safety Requirements”…

EN12675	Compliance	Comment
		EN12675 Section 1 – Scope
1	Noted	
		EN12675 Section 2 – Normative References
2	Clarification	Our interpretation is that the “HD638:1999” edition listed here has been superseded.
		EN12675 Section 3 – Definitions
3	Noted	
		EN12675 Section 4 – Functional Safety Requirements
4.1	Clarification	*... The specified fault condition shall be classified as a major or minor fault condition and acted on accordingly. …* Our interpretation is that the classification of faults as major or minor is stated in TR2500 and is not required to be configurable.
4.2	Clarification	***4.2 Application of Power*** *On application of power to the traffic signal controller, the controller shall undertake internal checks to ensure that the operating programs start in a pre-defined condition.* ***These checks shall ensure that all memories are initialised to their correct state and that all memory devices are checked.*** *In the event of an error, the traffic signal controller shall not change to the control mode of operation.* The failures of any devices (not just memory) have to be considered as part of the failure mode analysis of signal states that endanger traffic. Devices that do not impact this are outside of the scope.
4.3	Compliant	
4.4	Compliant	References to sections in HD638:1999 are now assumed to mean the appropriate sections in HD638:2001 and EN50556:2011.
4.5.1 Class AA1	Compliant	*4.5 Conflict faults* *4.5.1 Signal group conflicts (unwanted signals)* *The simultaneous display of configured conflicting signal groups shall have an effect according to one or more of the following classes:* *a) Green-green conflict – Class AA1: The occurrence of any signal group green signals displayed simultaneously with any conflicting signal group green signals shall register a fault.* Class AA1 (Green / Green Conflict) – Compliant.
4.5.1 Class AB1 Class AD1	Clarification	*b) Green-yellow conflict – Class AB1: The occurrence of any signal group green signals displayed simultaneously with any conflicting signal group yellow signals shall register a fault.* *c) Yellow-yellow conflict – Class AC0: There is no requirement to check for conflicting yellow signals.* *d) Green-red/yellow conflict – Class AD1: The occurrence of any signal group green signals displayed simultaneously with any conflicting signal group red/yellow signals shall register a fault.* *e) Green-green/yellow conflict – Class AE0: There is no requirement to check for conflicting green and green/yellow signals.* Our implementation of Classes AB1 and AD1 is as follows: Each phase will be checked in turn. If the Green of the phase is illuminated, either by request or by a fault, all the phases configured to conflict with this phase will be checked. A conflict will be confirmed if the Green of any these phases is illuminated, or the Yellow is illuminated and configuration data indicates that the Yellow should be included in the check. In effect, the check is one phase at Green and a conflicting phase has either the Green or Yellow illuminated.

EN12675	Compliance	Comment
		We believe the Works Specification must specify which phase Yellows are to be included in this check since, for example, pedestrian phases may use the Yellow output to drive the Wait indicators and these will be legitimately illuminated while a conflicting phase is at green. This allows Green – Yellow Conflicts (AB1) to be detected, but does not trigger when conflicting phases both appear at Yellow, since Class AC0 implies that Yellow – Yellow Conflicts should not cause a fault to be registered. And in addition, we believe it is sometimes acceptable for the yellow leaving period of one phase to overlap the red/yellow starting period of a conflicting phase. This mechanism also treats a phase displaying Red & Yellow the same as a phase displaying only Yellow for conflict purposes, and thus meets the requirements of Class AD1 (Green – Red/Yellow Conflict). It should be noted that it is therefore not possible to enable Green – Red/Yellow conflict checking between two phases without also enabling Green – Yellow conflict checking. We draw the reader's attention to the fact that Green – Yellow conflict checking will not be enabled between the phases of a UK Pelican since Period F of this signal sequence (TR2500A Clause J35) requires that both Pedestrian Green and Vehicle Amber are illuminated at the same time during the normal Pedestrian to Vehicle Phase Intergreen.
4.5.2	Noted	*Signal group green / absent red conflict… no requirement to check …* We note that there are no requirements to check for a green / absent red conflict.
4.5.3	Noted	*Absent red / absent red conflicts … no requirement to check …*
4.6	Noted	*National signal regulations (unwanted signals) … no requirement to check …*
4.7.1	Clarification	Our interpretation of these classes (below) is that they only require the monitoring of vehicle red signals as required by TR2500, since failures of pedestrian red signals for example are not considered a signal state endangering traffic in the UK.
4.7.1 Class CA1	Clarification	*Class CA1: The absence of a red signal on specified signal groups shall register a fault.* Our interpretation of this class is that a single red lamp failure on any vehicular phase shall register a fault and where configured on intersection stage streams, may extend the intergreen (i.e. all-red period) to conflicting phases as required by TR2500.
4.7.1 Class CB1	Clarification	*Class CB1: The absence of the last red signal on any vehicular signal group shall register a fault.* Our interpretation of this class is that disconnection of all vehicle red lamps from a red phase output ('feeder failure') will be treated the same as a second red lamp failure (i.e. as CC1 below).
4.7.1 Class CC1	Clarification	*Class CC1: The absence of red signals on a number of signal heads specified for each signal group shall register a fault.* Our interpretation of this class is that a second red lamp failure on a vehicular phase shall register a fault. And where configured shall either inhibit the appearance at right of way of conflicting pedestrian phases (intersection stage streams only) or cause all traffic signals within the same stage stream to be extinguished (intersection or stand-alone pedestrian stage stream), as required by TR2500. We note that TR2500 Appendix J requires that reds controlled by the same phase to be monitored by a number of 'red lamp monitors', such that the absence of one red lamp on each of two monitors does not trigger the 'second red lamp failure' actions for example. We also note that Class CC1 refers to a number of absent red signals on a 'signal group', i.e. phase, and makes no mention of separate approaches or monitors. Our interpretation is therefore that multiple 'red lamp monitors' on a phase are only required at Stand-alone Pedestrian installations. At all other installations it is acceptable that one red failing on each of two approaches controlled by the same phase triggers the 'second red lamp failure' actions for example.

EN12675	Compliance	Comment
4.7.2	Noted	*Absent signal groups, yellow or green signals … no requirement to check …*
4.8 Class DA1	Clarification	*4.8 Compliance checking* *The traffic signal controller shall ensure that the state of the signals is in accordance with the commands given by the traffic signal controller logic. Compliance is ensured if, and only if, the state of the signals is in accordance with the command given.* *Class DA0: There is no requirement to check for compliance.* *Class DA1: Lack of compliance exceeding a time interval for the requirements for signalling specified in HD638 shall register a fault.* See our General Query #2.4 on page 9.
4.9 Class FA1	Clarification	*4.9 Safety Timings* *The traffic signal Controller shall check that the values of safety timings are in accordance with national requirements for the following classes:* *a) Stored values of timings* *Class FA1: The stored values of timings shall be checked. The check shall ensure that the stored values are not corrupted. In the event of an error, the traffic signal controller shall register a fault.* See our General Query #2.2 and #2.3 on starting on page 6. Our interpretation of this clause is that the time to find a checksum fault and enter failure mode is 10 seconds (diagnostic check interval as described in EN12675 4.3) and not 500ms (class AG5), and that the sub-systems responsible for detecting the corruption do not require the application of Class X1 of HD638 (Failure Mode Analysis).
4.10	Noted	*National signal sequences … no requirement to check …*
4.11 Class HA1	-	See our comments against TR2500 clause 3.15 on page 26.
		EN12675 Section 5 – Fault Condition
5.1	Compliant	
5.2	Compliant	
5.3	Compliant	Also see our General Query #2.2 “Query – Signals States Endangering Traffic” on page 6.
5.4	-	Storage of Faults – See our comments against the National Requirements in TR2500, starting with clause 3.10 on page 26 of this document.
		EN12675 Section 6 – User Documentation
6	Compliant	
		EN12675 Section 7 – Marking and Labelling
7	Clarification	*The marking and labelling system shall ensure that installation and maintenance do not adversely affect the safety parameters. Memory devices holding permanent data shall be marked with a unique designation and all replaceable modules shall be marked to ensure correct type and fitting. Additional requirements are given in HD 638:1999.* Compliant, except where noted below. We believe *‘Memory devices holding permanent data’* refers to replaceable PROM devices held in sockets and not soldered down FLASH and EEPROM devices. Memory devices that are not replaceable cannot be swapped during installation and maintenance so we believe they do not require a physical label. Where the contents of a memory device can be modified in situ (reprogrammed), there is a risk that any physical label becomes out of date leading to confusion and mistakes. Our controllers provide up-to-date identification and version information of the contents of such devices that can be retrieved and displayed on user interfaces. We therefore do not use physical labels on such devices.
		End of EN12675

5. Compliance against TR2500

This section contains comments against the clauses in "TR 2500, Specification for Traffic Signal Controller, Issue A, November 2005"…

TR2500	Compliance	Comment
		TR2500 Section 1 – Introduction
1.1-1.9	Noted	We have approval for our traffic controllers for use with all the appendices included in TR2500, although our small dedicated single and dual pedestrian controllers will typically only need to support the following appendices: • Appendix C – Cableless Linking (Refer to C9 for details) • Appendix J – Pedestrian Facilities • Appendix K – User Interface • Appendix L – Speed Measurement. Refer to our comments on particular clauses for clarification and queries details.
		TR2500 Section 2 – European Harmonised Standards
2.1-2.2	-	See our separate comments on HD638, starting on page 12 of this document, and EN12675, starting on page 21.
		TR2500 Section 3 – National Requirements
3.1	Clarification	***Signal Sequences*** *3.1 Regulations require that traffic signalling equipment must be designed to present to the road user **only** those signals and signal sequences defined in the Traffic Signs Regulations and General Directions 2002, Regulations 30(2)(3)(4), 31 and 37 and "The Zebra, Pelican and Puffin Crossing Regulations and General Directions 1997."* Even though the controller firmware is capable of providing various export sequences, the signal sequences are fixed as those to meet the UK requirements. However, for export markets, the configuration PC tool 'IC4' includes a clear option to mark the configuration as 'non-UK' and only when this has been selected can the signal sequences be modified.
3.2	Compliant	***Controller Start Up Sequence*** **General** 3.2 Where junction, junction linked pedestrian and stand-alone Pelican, Puffin and/or Toucan facilities are provided within the same controller, then each facility shall function independently of the other with regard to start up requirements.
3.3	Clarification	**Junction Control** 3.3 On restoration of the mains supply to the controller, it shall be permissible for no signals to be shown for a period not less than 7 seconds nor exceeding 60 seconds. ('All off' period following power up). The 'All off' period may be omitted if the signals have already been off for a period exceeding 7 seconds. After the expiry of this period, the controller shall recommence operation with the establishment of the stage pattern subject to the following constraints: a) vehicular phases which in Stage 1, or any other nominated 'start-up' stage, will show a red signal, shall commence with an amber signal for a period of 3 seconds followed by red; b) during the amber period the signals for vehicular phases which will eventually show green, or green arrow, during stage 1 show the all signals off condition. They shall then show a full green signal at the end of a timed period known as the starting intergreen period. This period shall start at the commencement of the red signals of (a).It shall be possible to preset the starting intergreen period; all pedestrian and cycle signals shall be set to show red at the start of the amber in (a). c) On restoration of the mains supply to the controller, demands shall be inserted (in appropriate modes of operation) for all phases to ensure that no vehicles are trapped against a phase.

TR2500	Compliance	Comment
		Compliant, although we draw attention to a couple of issues with the wording: 1) One interpretation of the wording *"it shall be permissible for no signals to be shown for a period not less than 7 seconds nor exceeding 60 seconds"* allows the 'All Off' period to be very short because of the word 'permissible'. We believe this could be dangerous since it would allow the signals to resume shortly after they were switched off. Our implementation of these clauses is to always insert an 'All Off' period of at least 7 seconds at the beginning of any start-up sequence. Reviewed with David Overton (HA Representative) on 26/27 April 2006 and the recommendation was to reword the beginning of clauses 3.3, 3.4 and 3.5 as follows: *"On restoration of the mains supply to the controller, no signals shall be shown for a period of not less than 7 seconds nor more than 60 seconds. ('All off' period following power up). The 'All off' period may be omitted if the signals have already been off for a period exceeding 7 seconds."* 2) We believe the wording at the end of clause 3.3c) is unclear and have interpreted to mean: "…to ensure that no vehicles are trapped against a red."
3.4	Compliant	**Pelican Control** 3.4 On restoration of the mains supply to the controller, it shall be permissible for no signals to be shown for a period not less than 7 seconds nor exceeding 60 seconds. ('All off' period following power up). The 'All off' period may be omitted if the signals have already been off for a period exceeding 7 seconds. After the expiry of this period, the controller shall recommence operation at the start of the flashing amber to vehicles/flashing green man period to pedestrians with a stored pedestrian demand. [Same comment on the use of the word 'permissible' as in 3.3]
3.5	Clarification	**Puffin/Toucan/Equestrian Control** 3.5 On restoration of the mains supply to the controller, it shall be permissible for no signals to be shown for a period not exceeding 60 seconds. ('All off' period following power up). After the expiry of this period, the controller shall recommence operation in accordance with the following sequence. 1) We note that the 7-second lower limit has been added to clauses 3.3 and 3.4, but in error has been omitted from clause 3.5 (see the comments against clause 3.3). Our implementation of these clauses is to always insert an 'All Off' period of at least 7 seconds at the beginning of any start-up sequence. 2) Same comment on the use of the word 'permissible' as in 3.3.
3.6	Compliant	3.6 The pedestrian (or cyclist or equestrian) signals shall be set to show the red signal. At the end of a timed period, the starting intergreen, a full green signal shall be shown to vehicles. A stored demand for pedestrians/cyclists/equestrian shall be inserted.
3.7	Clarification	***Traffic Regulatory Signs*** *3.7 Signs may be switched on or off at specific times, usually under part time control. This action may, (if required), also be delayed until the appearance of specified phase green signals or alternatively the appearance of a specified stage.* According to TR2523A, regulatory signs are driven from a separate supply not linked to the controller lamp supply and as such are normally 'always on' and are not switched. We do not believe this requirement has changed and therefore believe this clause in TR2500 may be confusing. Our implementation will be to TR2523A – see our comments against clause 2.12 of TR2523A on page 54. If required, 'Switched Signs' can be driven from spare phase outputs under the control of 'special conditioning' which can decide when to turn the sign on and off. With our small dedicated single and dual pedestrian controllers, Regulatory Signs may require the addition of a kit not normally supplied and the limited number of phase drive outputs may not allow for 'Switched Signs'.
3.8	Compliant	In practice, if the mode priority structure were not specified, then we would discuss this with the author of the Works Specification rather than try to apply a default priority list.

TR2500	Compliance	Comment
3.9	Clarification	*3.9 Any changes in the method of control shall eliminate the risk of vehicles and pedestrians being excessively delayed or trapped due to lost demands or extensions. This shall be performed on every control method change by either inserting demands on all non running phases or by continuously assessing demands and extensions against the associated greens and inserting the outstanding demands and extensions.* In our implementation the controller continuously assesses demands and extensions and thus these are ready and up-to-date for any change in the mode of operation. In addition, if required by the customer, artificial demands can be inserted when leaving Manual or Fixed Time modes of operation to ensure that all phases eventually gain right of way after leaving these modes.
3.10-3.14	Clarification	***Fault recording*** *3.10 Fault recording facilities shall be provided in the controller in accordance with BS EN 12675:2000 5.4 Storage of Faults.* *3.11 The fault log shall record the date and time of fault clearances.* *3.12 The fault log shall have, as a minimum, the capacity to record 255 events.* *3.13 The requirement not to overwrite major fault entries until they have been manually cleared may be met by the provision of a current fault log of uncleared faults with a minimum capacity of 64 fault entries together with an historic record (minimum 255 entries capacity) containing all faults and recorded events which is overwritten when full.* *3.14 All fault data shall be preserved in the event of a power supply failure for a minimum of 30 days.* In our implementation, two types of fault log exist within the controller. The current fault log holds all the un-cleared faults to allow easy examination of which faults have been detected when the system error LED is illuminated. The fault log is large enough to hold all possible un-cleared faults. This fault log may not include the date and time of the fault occurrence. The second is an event log that records the date and time of every fault occurrence and clearance (plus additional events such as power off and power on) as they occur. The size of each event within the log is variable, but normally this log will be able to record the last 255 events before overwriting the older events.
3.15	Clarification	*3.15 The fault recording system shall have the capability of detecting and recording faults from external inputs (such as detectors) as required by class HA1.* *EN12675 section 4.11 – Class HA1: In the event of a configured input indicating a fault of the external equipment the traffic signal controller shall register a fault.* We believe this clause is intended to allow a controller to have the potential to receive fault reports from any external equipment. However, it is impossible for any manufacturer to develop a controller today that can receive fault information from any external equipment some time in the future unless the interface is defined now. Our interpretation is therefore that the controller must meet this clause only for all input interfaces defined in TR2523A, i.e. digital I/O, and our implementation will allow a small number of digital inputs to be defined which can be configured to set faults in the log using special conditioning.
3.16 3.17	Clarification	***Fault recording*** *… …* *3.16 Major faults are defined as those described in the following classes of BS EN 12675.* *AA1; AB1; AD1; DA1; FA1* *3.17 Other faults are defined as minor faults.* *3.18 The Works Specification may require certain other faults to cause the controller to switch off.* ***Failure mode*** *3.19 In the event of a major fault, the failure mode shall be "all signals off" including non-operation of "wait" and demand indicators and tactile and audible devices.* See our General Query #2.2 on page 6. We also recommend that clauses 3.16 to 3.19 should all be under the heading 'Failure mode'.

TR2500	Compliance	Comment
3.18	Clarification	*3.18 The Works Specification may require certain other faults to cause the controller to switch off.* Our interpretation of this clause is that the Work Specification can specify **additional** faults should cause the signals to be extinguished, but not cause failure mode. We wish to make it clear that any fault we deem must extinguish the signals for safety reasons (but is not explicitly listed in clause 3.16) will always extinguish the signals. Our interpretation of clause 3.18 is that it does ***not*** permit the Work Specification to request that such faults do not extinguish the signals against our advice.
3.19	Compliant	
3.20	Compliant	
		TR2500 Section 4 – Normative References
4.1	Noted	
4.2	Noted	See our separate comments on HD638 and EN12675, starting on page 12.
4.3	Noted	Our interpretation of the references to the other TR25xx specifications in this section is that they are for information only or for inclusion in customer Work Specifications. They do not contain requirements on the traffic controller itself, except for explicit references to parts of these specifications within the clauses of TR2500. See our separate comments on TR2523, starting on page 51.
4.4	Noted	Our interpretation of the references in this section are for information only and do not contain requirements on the traffic controller itself, except for explicit references to parts of these specifications within the clauses of TR2500.
4.5 4.6	Noted	
		TR2500 Section 5 – History
5	Noted	
		TR2500 Appendix A – Fixed-Time
A1 A2	Noted	We have approval for our intersection traffic controllers against Appendix A Fixed-Time and for up to eight parallel stage streams.
A3 A4	Noted	We have self-certified that our controllers meet this Appendix as written, except where noted in this document.
A5	Clarification	***Essential requirements*** *A5 The controller shall provide, as a minimum, four phases and four stages.* In our implementation, Traffic Controllers supplied for control of intersections will be able to drive least four phases and the firmware will be able to support at least four stages. However, Traffic Controllers supplied for control of a single stand-alone pedestrian crossing to Appendix J may only be equipped to drive two phases. We do not believe this contradicts this requirement in Appendix B that, in our interpretation, only covers Fixed Time operation at intersections.
A6	Clarification	***Functional Requirements*** *A6 With Fixed-time method of control, the stages shall appear in a specified order for pre-set fixed-time periods. If the controller is designed for Vehicle Actuated control the fixed periods under Fixed-time control shall be the currently active stage maximum periods and input signals from the detection systems or pedestrian push buttons shall be ignored.* Our implementation supports both Fixed Time and Vehicle Actuated modes of operation. The customer can decide (at the time of configuration) whether fixed time operation runs *'pre-set fixed-time periods'* (true fixed time mode) or *'currently active stage maximum periods'* (what we call 'fixed time to current maximums'). Our implementation of 'fixed time to current maximums' also allows customers to specify which phases to continue to respond to street demands and/or extensions.

TR2500	Compliance	Comment
A7	Clarification	*A7* *On controllers with alternative methods of control, Fixed-time method of control may be introduced by a switch or push button on an accessible position on the controller (on the Manual Control Panel if provided) or by timetable or remote command form a UTC or other remote system.* Manual Panel: In our implementation, there is a switch on the manual panel (if required) to override the mode of operation to Fixed Time mode. This 'selected' FT mode appears higher in the mode priority table than 'normal' FT mode to allow it to override some but not necessarily all other modes. Timetable: If the timetable selects CLF plans (as required by Appendix C), then the 'fall back' when no CLF plan is selected from the timetable can be configured to be FT mode. Special Conditioning can also be used with the timetable to switch to Fixed Time mode at other times. UTC: The controller will naturally 'fall back' to Fixed Time mode when there are no active UTC Force Bits (depending on the mode priorities), but there is no standard TR2523A UTC bit to select FT mode, i.e. no *'remote command from a UTC system'*. If a customer explicitly requested such a 'remote command', Special Conditioning can be used to select FT mode (by disabling selected higher priority modes for example) on activation of a control bit from a UTC system for example.
A8 A9	Clarification	*A8* *It shall be possible to define the stage sequence for the fixed-time method of control.* *A9* *Any phases which may run conditionally within stages in the Vehicle Actuated method of control shall always run if the appropriate stage appears in the Fixed-time method of control.* Our interpretation is that these clauses refer only to 'true' fixed time mode, and not 'fixed time to current maximums'. Also see our response to Clause A6 above.
A10	Compliant	
A11	Compliant	
A12	Compliant	
A13	Compliant	
A14	Clarification	***Stage Stream Restrictions*** *A14* *It shall be possible to restrict the independent operation of stage streams in the following ways:* *a) by direct influences between stage streams. It shall be possible for one stage stream to have its stage changes conditioned by the state of another stage stream, and/or;* *b) by declaring conflicts (and phase intergreens) between selected phases in the different stage streams.* a) Our controllers provide features within the 'special conditioning' facility to allow multiple stage streams to be controlled. b) In our implementation, conflicting phases can be allocated to different stage streams, although we would recommend against this. If the phases are not permitted to appear at right of way at the same time for safety reasons (i.e. are conflicting), then we would recommend that they must be allocated to, and controlled by, the same stage stream.
		TR2500 Appendix B – Vehicle Actuation
B1 B2 B3	Noted	We have approval for our intersection traffic controllers against Appendix B Vehicle Actuation and we self-certify that our controllers meet this Appendix as written, except where noted in this document.
B4	Compliant	

TR2500	Compliance	Comment
B5	Clarification	*B5 This requires the ability to receive demands for stages or for individual phases. It also has the ability to overlap extensions for the same phase so that, with multiple detectors for the same traffic stream, the total extension granted for an individual vehicle may be varied according to the speed of the vehicle.* Our interpretation is that with the usual XYZ three detector configuration of System D, the fixed extensions generated by each activation of each loop would, in effect, overlap and therefore, the sooner the vehicle activated the last detector, the sooner the all extensions triggered by the vehicle would expire. Our interpretation is that this clause does not require the duration of each extension to be varied depending on the actual speed of the vehicle.
B6	Compliant	
B7	Noted	
B8-B9	Compliant	
B10-B16	Compliant	
B17-B22	Compliant	
B23	Compliant	
B24	Clarification	***Quiescent Signal State*** *B24 In the absence of demands or extensions, the signals may move to the All-Red or other nominated stage as required in the Works Specification.* Our understanding is that the quiescent state should only be invoked when there are no demands **and** no extensions present. We believe that this clause should be reworded as follows: *"In the absence of **all** demands **and** extensions, the…"*
B25	Compliant	***Detector Monitoring*** *B25 The input signals from the detector equipment shall be monitored by the controller. Pedestrian push buttons may, when required, be treated as vehicle detectors for fault monitoring purposes.*
B26	Noted	*B26 If Puffin or other facilities involving on-crossing detection are provided at a junction, on-crossing detector monitoring as specified in Appendix J shall be provided if so required by the Works Specification.* See our comments against Appendix J.
B27-B31	Compliant	***Detector Failure Conditions***
B32	Clarification	***Detector Failure Action*** *B32 If a detector failure occurs an artificial demand shall be set which shall be removed only when the detector fault is cleared and b) the fault flag shall be set. If a fault monitor (FM) indicator is provided it shall be lit when the fault flag is set.* In our implementation, for each detector, three configuration options are available: force detector input active, force detector input inactive or do not force detector input. Thus, an artificial demand can be set (by forcing the detector input active) if required.
B33	Compliant	
		TR2500 Appendix C – Cableless Linking
C1-C3	Noted	We have approval for our intersection and pedestrian* traffic controllers against Appendix C Cableless Linking and we self-certify that our controllers meet this Appendix as written, except where noted in this document. * Refer to our response to clause C9.
C4-C7	Compliant	

TR2500	Compliance	Comment
C8-C10	Clarification	*C8 The necessary timing signals for the execution of a specific plan shall be derived from the group timer using the following periods:* *• Offset Time – The offset time shall relate the start of the timing cycle on the individual controller to reference time. Alternatively offset times can be derived by varying the times of introduction of particular plans on linked controllers;* *• Cycle Time – The cycle time shall be equal to the summation of the individual group timings;* *• Group Start Time – Group start time shall be the time that each group commences from the start of the cycle time.* Our implementation for these times is explained below: Offset Time – Both options are used depending on the type of CLF option configured. For our 'base time' CLF option, the plans are synchronised to a 'base time' or 'reference time'. Offset times can be configured for each plan to adjust these as described above. For our 'non base time' CLF option, the start time of the CLF plan can be used to adjust the 'offset' as described in TR2500. Cycle Time – To ease configuration and maintenance, the cycle time of a plan is a separate configuration value; it is not calculated from the summation of the group timings. In our experience, defining the cycle time as the summation of the group timings causes issues when the user changes one 'group time'. This immediately changes the cycle time which is typically an undesirable side effect, requiring the user to explicitly alter another 'group time' to compensate. Group Start Time – Implemented as described, although it should be noted that this 'start time' description does seem to contradict with the wording in the definition of a cycle time, which implies group times are durations that can be summed to given the overall cycle time.
C9	Clarification	Our understanding is that the functions described here are not applicable to stand-alone pedestrian stage-streams. In our implementation, our controllers do provide a Cableless Linking facility for stand-alone pedestrian stage-streams. On these stage-streams, the listed intersection functions are not used. Instead, a single function is provided to inhibit the pedestrian phase and hold the vehicle phase in a similar manner to that required by clause J30.
C10	Clarification	*C10 The plan may also allow stages to be introduced or deleted, within the constraints of the basic stage/ phase definitions. Hence, phases may be allowed to run or be prevented from running. The stage structure changes made by a plan (by including or deleting stages) shall only apply whilst the controller is operating the Cableless Linking method of control.* Stages can be 'deleted' / 'prevented from running' by simply omitting those stages from the plan. By implication, to allow stages to be 'introduced' / 'allowed to run' implies that those stages did not run in other modes. This can be achieved though various mechanisms on our controllers, including special conditioning for maximum flexibility.
C11	Clarification	***Changes to Method of Control and Plan Changes*** *C11 If the method of control is to change to CLF, implementation of the 'new' stage may be delayed until the start of the next group timing period. This delay shall also apply if a plan change occurs whilst operating the CLF method of control.* Our interpretation of this clause is that it describes an optional implementation. Our controllers immediately move to the stage required by the currently active group, subject to safety timings. As an option, a 'plan start time' can be specified which prevents the plan starting until this configured point in the cycle is reached.
C12	Compliant	

TR2500	Compliance	Comment
C13	Clarification	*C13 When a new plan is implemented by the timetable it shall always commence with the first group.* This is normal operation with our 'non base time' mode of operation – all plans start with the first group when the timetable requests the plan to start. With our optional 'base time' mode of operation, all plans are synchronised to a configurable 'base time' and so the time at which the plan is introduced does not affect its synchronisation. Therefore, the plan may start at any point within its cycle. As an option, a plan start time can be specified which prevents the plan starting until this configured point in the cycle is reached.
C14 C15	Compliant	
		TR2500 Appendix D – Part-Time Operation
D1 D2	Noted	We have approval for our intersection traffic controllers against Appendix D Part-Time Operation and we self-certify that our controllers meet this Appendix as written, except where noted in this document.
D3- D8	Compliant	
D9	Query	***Red Lamp Monitoring*** *D9 Upon the confirmation of the failure to illuminate of all the red lamps in the primary signals of a vehicle approach (Class CD1), all the signals shall be extinguished.* We believe that the wording in clause D9 has been added in error following aborted discussions on the draft specification, and believe it should read as follows; based on TR2210A section 9.11.3 and 9.11.4.1, and this is our implementation. *D9 Upon the event of a second vehicle red lamp failure on the same phase, vehicle red lamp feed failure or failure of the vehicle red lamp monitor, all the signals shall be extinguished.* [Agreed with David Overton (HA Representative) on 26/27 April 2006] Our understanding is also that the same Red Lamp Monitoring facilities requested by TR2210A are required by TR2500. We therefore believe that the following clause should be added, based on TR2210A section 9.11.4.3, and this is our implementation. *(new) Confirmation of the failure must occur within 500ms of the fault, unless the failure occurs before or within 500 milliseconds of the start of the monitored vehicle red. In this circumstance, action shall be taken within 1 second of the start of the red.* [Agreed with David Overton (HA Representative) on 26/27 April 2006, and should also appear in the Red Lamp Monitoring required in Appendix J]
D10 D11	Compliant	*D10 Other junction or stand-alone stage streams (as specified in the Works Specification) shall also be extinguished.* *D11 Following the shut down of a part-time junction, the facility shall not be restored until the fault has been rectified and the controller reset. The controller will need to be manually reset. The signals shall then go through a controlled start–up sequence.*
		TR2500 Appendix E – Hurry Call
E1- E3	Noted	We have approval for our intersection traffic controllers against Appendix E Hurry Call and we self-certify that our controllers meet this Appendix as written, except where noted in this document.

TR2500	Compliance	Comment
E4	Clarification	***Use of Hurry Calls*** *E4 The purpose of the Hurry Call is to enter a priority demand for a particular stage to ensure that a green signal is given to certain vehicles. Hurry Calls may be used at junctions, or stand-alone signals near to fire or ambulance stations, to ensure that certain vehicles are given right-of-way, or in conjunction with queue detectors to prevent blocking of a junction. This Specification enables stand-alone pedestrian facilities to reside on All-Red signals which may now be influenced by Hurry Call demands subject to protection of safety timings.* In our implementation, the Hurry Call Method of Control is not available on stand-alone pedestrian stage-streams because those streams only run the Fixed Vehicle Period, Vehicle Actuated and Linked Methods of Control as required by Appendix J. However, in those rare cases where a Hurry Call feature is required at a stand-alone pedestrian facility the feature can be provided using Special Conditioning.
E5-E8	Compliant	
E9 E10	Compliant	
E11-E15	Compliant	
E16-E18	Compliant	
		TR2500 Appendix F – UTC and MOVA
F1	Noted	We have approval for our intersection traffic controllers against Appendix F UTC and MOVA, and we self-certify that our controllers meet this Appendix (and all subcategories) as written, except where noted in this document. It is our understanding (and our implementation) that Stand-Alone Facilities should not support the UTC Method of Control (also known as 'Mode of Operation'), but should support a UTC interface and the Control and Reply bits for Stand-Alone Facilities described in TR2523.
F2	Compliant	*F2 Equipment may be approved under this appendix in one or more of the following subcategories:* *a. UTC/MOVA interface. A controller approved to Appendix F (a) will have an interface which will allow either a standard UTC Outstation Transmission Unit (OTU) or a separate MOVA unit to be connected.* *b. Integrated UTC. A controller approved to Appendix F (b) will incorporate an integrated OTU enabling it to be connected directly to a UTC data transmission system.* *c. Integrated MOVA. A controller approved to Appendix F (c) will incorporate an integrated MOVA unit.* Our implementation of the three subcategories is as follows: a) UTC/MOVA interface – a 'free-standing' digital I/O interface as detailed in TR2523. b) Integrated UTC – the Controller and OTU are integrated, with the UTC interface internal to the combined equipment and not using digital I/O. c) Integrated MOVA – the Controller and MOVA are integrated, with the interface internal to the combined equipment and not using digital I/O.
F3-F5	Noted	
F6	Clarification	*F6 In the UTC method of control, the controller is 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. More details on UTC, including SCOOT (Split, Cycle and Offset Optimisation Technique) can be found in MCE 0360. MCH 1542 provides more details on MOVA (Microprocessor Optimised Vehicle Actuation).* Our interpretation of this cause is that it does not insist that MOVA must use the controller's UTC method of control, just that it may. We understand that it is permissible for the controller to provide a 'MOVA method of control' in addition to VA and UTC methods of control.

TR2500	Compliance	Comment
F7	Noted	*F7* *This section details the operation and facilities of the controller to be compatible with existing UTC systems under remote computer control and with existing MOVA equipment under local control.*
F8	Clarification	*F8* *The facilities described in this section shall be available in any combination, as required by the Works Specification. …* The combination of Control and Reply bits is flexible, however the total number of bits available is limited by the number of Control and Reply Words of the Outstation and the size of the interface used, e.g. number of available digital input and outputs.
F9	Compliant	
F10	Noted	
F11	Clarification	*F11* *Integral MOVA may be used as a fall-back mode for UTC.* We believe this clause should just say “MOVA may be used…”; regardless of whether it is using a separate UTC interface or it is integral, and this is our implementation.
F12-F14	Clarification	***OTU/Controller Interface*** *F12* *The Controller shall be linked to the transmission system by an OTU designed to MCE 0361 or other approved standard, normally housed within the Controller cabinet.* *F13* *Control and reply information between an OTU and the signal controller shall be presented at the OTU/Controller interface.* *F14* *The electrical and physical requirements of the interface are specified in TR 2523 Traffic Control Equipment Interfacing Specification.* Our interpretation is that these clauses only apply to the subcategory “a) UTC / MOVA Interface”. Agreed with David Overton (HA Representative) on 26/27 April 2006.
		TR2500 Appendix G – Manual Control
G1-G3	Noted	We have approval for our intersection traffic controllers against Appendix G Manual Control and we self-certify that our controllers meet this Appendix as written, except where noted in this document. Note: Manual Facilities on a stand-alone controller are covered by Appendix J.
G4	Compliant	
G5-G10	Compliant	
G11	Clarification	***Set No. 3 (Part Time Signals Only)*** *G11* *The following facilities shall be provided:* *…* *e) a switch to override normal part time operation as follows:* *“on” – signals permanently on;* *“off” – normal operation where the signals follow the requests for parttime operation.* In our implementation there are a number of spare switches available on our standard manual panel that can be configured to perform various functions, including the function described, if explicitly requested in the Works Specification.
G12	Query	*G12* *A facility shall be provided which will inhibit the selection of manual facilities set no 2 with the exception of the signals on/off switch and optionally the All-Red call switch as defined in the Works Specification. An indicator shall be provided to show that the stage switch facilities are not available when this facility is active.* Firstly, it is not clear whether the above also applies to ‘Set No. 3 (Part Time Signals Only) and whether the effect of the switch described in G11 e) should also be inhibited.

TR2500	Compliance	Comment
		Our interpretation is that the requirement is to inhibit the operation of the stage call switches described in G9 c) and optionally d) and the selection of 'manual mode' using the switches described in G9 b). The requirement is not to inhibit the 'fixed time' switch (nor any other mode switches) described in G9 b). We therefore recommend the following words: *G12 A facility shall be provided which will inhibit the selection of manual method of control in Set No. 2 and Set No. 3. If requested in the Works Specification, the All-Red call switch in G9 d) should still be functional while this inhibit is active. An indication shall be provided to show that the stage switch facilities are not available when this facility is active as required by G22.* In our implementation, manual method of control can be disabled initially in the configuration and enabled/disabled by handset command (MND). This inhibits the manual selection of stages, including the all-red stage. It does not inhibit the operation of other mode select switches, e.g. the fixed time switch on the manual panel, nor the signals on/off switch. If it is explicitly requested, then special conditioning can be used to select the All-Red stage when the All-Red button is pressed. See G22 for details on the indicators.
G13	Compliant	
G14	Clarification	***Automatic Reversion from the Manual Method of Control to Normal Working*** *G14 Closure of the manual panel door shall cause the controller to revert from manual operation to normal working, (i.e. as if the selection switch had been returned to the Normal position).* In our implementation, the door switch is always fitted when our standard cabinets and manual panels are used. In instances where a door switch is not fitted, automatic reversion when the door is closed cannot be provided.
G15	Clarification	*G15 Closure of the manual panel door under conditions of power failure shall cause the controller to start up in the normal working mode when power is restored.* Our implementation is that, since the fitting of a manual panel door switch is optional (see above), the controller will automatically exit manual mode if the power is switched off and on, regardless of the state of the manual panel door. This ensures that, should the power fail while manual mode is active, the controller will automatically resume normal operation when the power returns, even if no door switch is fitted.
G16-G24	Compliant	
G25 G26	Compliant	
		TR2500 Appendix H – Warden Control
H1-H3	Noted	We have approval for our intersection traffic controllers against Appendix H Warden Control and we self-certify that our controllers meet this Appendix as written, except where noted in this document. Note: Since this document is only concerned with the approval of our Traffic Controllers, various clauses referring to the remote box are not directly applicable.
H4 H5	Noted	
H6	Clarification	*H6 A push-button or biased key-operated switch may be specified which, when operated, shall cause an intergreen period to be extended for school crossing patrol use.The push-button or switch shall be mounted within or on a remote box, the design of which shall be agreed, prior to manufacture, with the Approval Authority.* Various timings, including intergreen periods, can be extended using our Special Conditioning facility from various stimuli, including inputs from push-buttons for example.
H7	Noted	*H7 The voltage applied to the device(s),specified in clause H6, shall be ELV as defined in BS 7671.*

TR2500	Compliance	Comment
H8	Compliant	
H9	Clarification	*H9* *Where a remote box is used it shall incorporate:* *a) either a push button; or a biased key-operated switch;* *b) a white indicator, which may be integral with item (a) and shall be illuminated when a demand for the extended intergreen period has been registered; and* *c) a green indicator, which shall be illuminated for the duration of the All-Red period. The white indicator shall extinguish at the start of this period.* Our controllers can be configured to provide inputs and outputs that can be used for this purpose.
H10	Noted	
H11 H12	Clarification	*H11* *The green indicator shall be subject to the green/green conflict monitoring requirements.* *H12* *It shall not be possible for the green indicator to be illuminated if either the indicator's supply has been turned off or the indicator's supply fuse has blown or the controller has shut down due to a fault.* Our controllers can provide a normal green phase output that meets these requirements; however the design of the remote box is outside of the scope of this document.
		TR2500 Appendix I – PSV Priority
I1 I2	Noted	We have approval for our intersection traffic controllers against Appendix I PSV Priority and we self-certify that our controllers meet this Appendix as written, except where noted in this document. We also note that customers' requirements for an LRT (Light Rail Transit) mode of operation are not defined in TR2500 and are different from this (Bus) Priority facility.
I3- I7	Compliant	
I8 I9	Compliant	
I10	Clarification	*I10* *When a priority extension runs a phase beyond its normal maximum running period then a normal demand shall be entered when the phase loses right-of-way during, or at the end of, the priority maximum running period. This demand insertion may be omitted only if, by monitoring the normal detectors, it is established that no vehicles or vehicle extensions are present.* In our implementation, the controller is continually assessing demands and extensions. It would naturally insert such a 'revertive' demand as required by clause B16 whenever the phase is terminated with an extension timer still running.
I11 I12	Compliant	
I13	Query	*I13* *An inhibit period shall only be introduced when a priority change has led to a phase green being prematurely terminated or a demanded phase not being run and will normally commence from the termination of the* ~~*priority*~~ *phase green or the point where the phase demand would otherwise have been actioned. Note: Where, following a priority demand, more than one stage change is required to reach the priority stage, it may be necessary to start the inhibit timer later to prevent the final stage change to the priority stage itself being inhibited.* Typing error: We believe the word 'priority' highlighted above has been added in error and must be removed; it was not in the equivalent paragraph in TR2210A. Agreed with David Overton (HA Representative) on 26/27 April 2006 to reword the clause; replace 'priority' with 'terminated'. It was also suggested that may be TR2500 needs to define what the inhibit period does as follows: *"Inhibit Period: A period following a priority change, during which priority changes originating from the same priority unit shall not occur, but priority extensions will still be serviced if the phase gains right of way through normal operation."*

TR2500	Compliance	Comment
		For consistency, our controllers will ***always*** start timing the 'inhibit period' (if conditions require it to run) when the priority phase gains right of way and not when the previous phases are terminated.
I14-I22	Compliant	
I23 I24	Clarification	*I23* *In the event of a PSV detector giving a permanent output for a time adjustable in the range 0–600 seconds in 30 second steps then, until reset, the output of the detector shall, have no further effect on the operation of the controller.* *I24* *The detector output may be either manually or automatically reset. Automatic reset shall only occur after at least 15 operations of the detector output.* We recommend that these clauses are reworded as follows to clarify the requirements and this is the basis of our implementation: *I23* *In the event of a PSV detector giving a permanent output for a time adjustable in the range 0–600 seconds in 30 second steps then ~~until reset~~ the output of the detector shall have no further effect on the operation of the controller.* *I24* *This condition may be either manually or automatically reset. Automatic reset shall only occur after at least 15 operations of the detector output.*
I25	Compliant	
I26	Compliant	
I27	Clarification	***Other Change of Level*** *I27* *If a controller is 'taken over' by UTC force signal(s) while a priority level is running, the force signal(s) shall have no effect until all vehicle extensions at the priority level have been satisfied. Subsequently, response to force signals shall comply with the requirements of Appendix F, unless further priority demands and/or extensions are received, and unless compensation periods are specified.* In our implementation, this is an available configuration option, but is not selected by default and thus must be specifically requested in the Works Specification.
I28 I29	Clarification	***Indicators*** *I28* *A suitable means shall be provided to display the status of all priority vehicle detection inputs, inhibit periods and compensation period(s).* *I29* *It shall be possible to observe all detection inputs of one priority level simultaneously. These shall preferably be indicated by either a suitable indicator behind the police facility door of the controller, or an indication on an engineer's plug in terminal via the RS232 port.* In our implementation, spare indicators on the manual panel (where available) can be used to show the state of the priority vehicle detection inputs, however, all the information required is available using the handset port.
		TR2500 Appendix J – Pedestrian/Cyclist/Equestrian Facilities
J1-J4	Noted	We have approval for our intersection and stand-alone controllers against Appendix J – Pedestrian / Cyclist / Equestrian Facilities (all subcategories) and we self-certify that our controllers meet this Appendix as written, except where noted in this document.
J5-J7	Compliant	
J8	Compliant	*J8* *Equestrian crossings with nearside indicators require the same sequence and timing ranges as Puffin Crossings. Equestrian crossings with far side signals require the same sequence and timing ranges as Toucan Crossings.* Given that the above clause appears early in Appendix J, we recommend that all further references to 'Equestrian' crossings are removed to help with the readability of this section.
J9-J11	Compliant	

TR2500	Compliance	Comment
J12	Clarification	*J12* *Any one or a combination of the junction, pedestrian and Toucan facilities may be provided, as called for in the Works Specification. If more than one facility is provided then each facility must operate independently ….* In our implementation, where more than one facility is provided, they will operate independently as required, although under major fault conditions, all facilities may be shutdown. Our intersection controllers can support any combination of facilities, limited only be the number of phases (32), stages (32) and stage-streams (8). Our dedicated small single and dual pedestrian controllers are limited to one or two stand-alone stage-streams respectively. *J12* *… and shall be provided with concurrently accessible manual facilities.* *J19* *Facilities (b) [Ped Demand], (c) [FVP / VA Switch] and (d) [Vehicle Extension] are optional on the manual panel. Where more than one facility is required e.g. a dual crossing, then the extra manual facilities must be catered for within the manual panel.* We do not believe it is practical for manual facilities (b), (c) & (d) to be available for each independent stand-alone facility when more than two facilities are used or when both junction and stand-alone facilities are used. In our implementation, we can provide a full intersection manual panel or a dual stand-alone facility panel, and we provide the maintenance engineer with equivalent and independent stand-alone manual facilities using the handset. Our interpretation is that only a single 'Signals On/Off Switch' is required to simultaneously extinguish the signals of all the stand-alone facilities and intersection stage streams of the controller, and this is our implementation.
J13 J14	Compliant	
J15	Compliant	
J16 J17	Query	***Detector Fault Conditions*** *J16* *Each detector input shall be individually monitored and fault logged as described in Appendix B including the timing of permanent detect and permanent non-detect states. In addition, the individual on-crossing pedestrian detectors shall be checked as follows.* **[Suggest split here – see comment below]** *If a signal has not been received from an on-crossing detector in the period between the end of the preceding clearance period (period 6 etc.) and the end of the current pedestrian green period (period 4 etc.), then a temporary artificial demand shall be inserted, being reset at the end of each clearance period. This demand will extend the clearance period (period 6 etc.) to its maximum. A fault does not need to be recorded when this occurs, but if one is, it must be automatically cleared when a signal is subsequently received from the on-crossing detector.* ***Detector Failure Action*** *J17* *If a detector failure occurs:* *a)* *it shall be possible, where specified, to set an artificial demand as follows:* *i) for an on-crossing detector, a temporary artificial pedestrian demand shall be inserted, being reset at the end of each pedestrian to vehicle phase intergreen gap or forced change;* *ii) for all other detectors, the artificial demand shall be permanent and shall be removed only when the detector fault is cleared.* *b)* *the fault flag shall be set and fault monitor (FM) indicator shall be lit (if provided).* *i) Once the fault flag has been set and the FM indicator (if provided) has been lit, it shall be reset only by operator intervention and an indication of which detector has failed shall be stored in the fault log.* Firstly, we recommend that the long clause J16 be split in two (as shown above) so that only the second part is referred to from elsewhere when discussing on-crossing detection.

TR2500	Compliance	Comment
		Our interpretation and our implementation is that when no signal is received from an on-crossing detector since the previous clearance period, then a temporary artificial demand should be inserted but no fault should be recorded. Only if no signal is received for a number of hours should a permanent artificial demand be inserted and a fault flag set, as for normal detector monitoring detailed in Appendix B. Agreed with David Overton (HA Representative) on 26/27 April 2006 to reword J17 as follows (or similar): *J17 If a permanent detect and permanent non-detect time-out occurs, it shall be possible, where specified, to set an artificial demand. The artificial demand shall be permanent and shall be removed only when the detector fault is cleared. The fault flag shall be set and fault monitor (FM) indicator shall be lit (if provided). Once the fault flag has been set and the FM indicator (if provided) has been lit, it shall be reset only by operator intervention. An indication of which detector has failed shall be stored in the fault log.*
J17 CONTINUED	Query	Firstly, we believe the note after J17 should be moved to follow clause J14 in the "Functional Requirements" sub-section and should be numbered as a normal clause and not be a note: *J_{NN} Where a crossing uses near-sided indicators and has a central refuge which has pushbuttons and indicators mounted on it, it shall be possible for the indicators mounted on the central refuge to display a blackout period after pedestrian green.* Secondly, we note that these words are similar to those from section 6.1 of TR2210A. However, we understand that the requirements for this option were modified and are now more complicated than just displaying pedestrian blackout on the central refuge. We therefore recommend that the full facility be described in detail if this has now been finalised. Until the requirements are finalised, we are unable to state how best we can implement them. Agreed actions with David Overton (HA Representative) on 26/27 April 2006 to move the note to earlier in the appendix and to find out if the requirements have been finalised, and consider whether they should be included in TR2500.
J18	Compliant	
J19	Query	*J19 Facilities (b), (c) and (d) are optional on the manual panel. Where more than one facility is required e.g. a duplicate crossing, then the extra manual facilities* **"[ADD] (b), (c) and (d)"** *must be catered for within the manual panel.* See our comments on Clause J12 above. We also recommend that the additional words added to clarify. Agreed with David Overton (HA Representative) on 26/27 April 2006.
J20-J23	Compliant	
J24 (J29)	Compliant	***Fixed Vehicle Period Method of Control*** *J24 Following the expiry of the vehicle maximum green time, any subsequent pedestrian demand shall be served after a configurable delay period of either 1, 2 or 3 seconds before period 'B' commences.* ***Vehicle Actuated Method of Control*** *J29 Following the expiry of the pre–timed maximum green period, any subsequent pedestrian demand shall be served after a configurable delay period of either 1, 2 or 3 seconds, before period B commences.* For J24, an optional facility is available to the customer, which introduces a configured fixed period (PDD) as required. The same facility, with the same period, can also be enabled for J29. However, for J29 an alternate enhanced facility is available as requested by some customers. This introduces a configured 'extra' vehicle maximum green period (PTX), which only holds the vehicle phase at right of way if vehicles are detected. In effect, the maximum green timer is restarted with a short period that allows gap changes as normal. We would recommend that this alternate facility be included in the next issue of TR2500.

TR2500	Compliance	Comment
J25- J28	Compliant	
J29	Compliant	See also our comments against clause G24 above.
J30 J47 J63 J79 J97	Query	***Linked Method of Control*** *J30* *The vehicle phase green shall be prevented from terminating if a hold vehicle (PV) signal is present. On removal of this signal the vehicle period shall terminate immediately* ***provided the minimum vehicle, or fixed, green period has terminated*** *and a pedestrian demand is present.* *J47* *The vehicle phase green shall be prevented from terminating if a hold vehicle (PV) signal is present. On removal of this signal the vehicle period shall be terminated* ***provided the minimum vehicle green period has terminated*** *and a pedestrian demand is present.* *J63 and J79 are the same as J30, while J97 is the same as J47.* Our interpretation of these clauses is that both J47 and J97 have omitted (in error) to include 'or fixed green period' (referring to fixed vehicle operation). We believe that in all pedestrian facilities, the UTC PV signal should not be able to curtail the fixed vehicle period and this is our implementation. Agreed with David Overton (HA Representative) on 26/27 April 2006 to change J47 and J97. For Cableless Linking at stand-alone facilities, see our response to clause C9.
J31	Compliant	
J32 J49 J65 J81 J99	Clarification	Functionally Compliant: ***Vehicle to Pedestrian Phase Intergreen – Periods B and C*** *J32* *These periods immediately follow the vehicle phase green and shall comprise:* *Period B – A fixed period of three seconds during which the signals shall display vehicle amber and pedestrian red.* *Period C – A period during which the signals shall display vehicle red and pedestrian red. The duration shall be dependent upon the highest of the following criteria applying at the time:* *a) fixed at 1, 2 or 3 seconds for a gap change in vehicle actuated operation;* *b) preset at either 1, 2 or 3 seconds for fixed vehicle period operation, linked operation, a forced change in vehicle actuated operation or if the fault flag specified in clause J17 is set;* *c) fixed at 3 seconds when speed measuring equipment is fitted.* Since any detector fault will also introduce an artificial demand (and extension), then all changes in vehicle actuated mode will be a 'forced change' (i.e. when the maximum green timer expires) and therefore time Period C (b) will be automatically selected, rather than Period C (a). Therefore, in our implementation, the fault flag is not explicitly checked.
J33 J50 J66 J82 J100	Clarification	***Invitation to Cross Period – Period D*** *J33* *This period during which the signals shall display vehicle red and pedestrian green shall immediately follow the vehicle to pedestrian phase intergreen, and shall be preset at a value in the range between 4 and 9 seconds, and adjustable in incremental steps no greater than one second.* In our implementation, a configurable lower and upper limit is available for each phase minimum green time allowing the configuring engineer to set the required range for each stand-alone pedestrian phase differently to the range for other phases. The range is not automatically fixed at 4-9 seconds.
J34	Compliant	

TR2500	Compliance	Comment
J35	Clarification	***Pedestrian to Vehicle Phase Intergreen – Periods E, F and G [Pelican Flashing Green Period]*** *J35 These periods shall immediately follow the 'Invitation to Cross' period and shall comprise the following:* ***Period E** – Operation with either the inclusion or exclusion of a period of 2 seconds during which the signals shall display vehicle red and flashing pedestrian green.* ***Period F** – A period during which the signals shall display flashing vehicle amber and flashing pedestrian green. This period shall be preset at a value in the range between 6 and 18 seconds, and adjustable in incremental steps no greater than 1 second.* ***Period G** – A period during which the signals shall display flashing vehicle amber and pedestrian red. If this period follows period F then this period shall be preset at a value of either 1 or 2 seconds. If this period follows period C then this period will be preset at a value of 3, 4 or 5 seconds. Upon termination the signals shall immediately go to the vehicle phase green (period A).* Period E – In our implementation, the handset range limits are set to allow any value in the 0 to 2 seconds. The controller does not prevent the engineer from setting a period of 1 second. Period F – See our comments against Class AB1 Green – Yellow Conflicts (on page 21). Period G – Our implementation provides two separate timings for this period. One that only runs during the normal operation sequence (1 or 2 seconds) and an alternative time (3 to 5 seconds), which only runs when leaving the optional all-red quiescent state. All range limits are configurable (access level 4).
J36	Compliant	
J37-J52	Compliant except…	Near-Side Puffin Stand-alone Facility Clause J37: Query: References to "J124 to J130" appear to be incorrect. [Agreed with David Overton (HA Representative) on 26/27 April 2006] Clause J47: See our comments against Clause J30 above. Clauses J49 & J50: Same comments as those against Clauses J32/3 above.
J53-J68	Compliant except…	Far-Side Toucan Stand-alone Facility Clause J63: See our comments against Clause J30 above. Clauses J65/6: Same comments as those against Clauses J32/3 above.
J69-J84	Compliant except…	Near-Side Toucan Stand-alone Facility Clause J79: See our comments against Clause J30 above. Clauses J81/2: Same comments as those against Clauses J32/3 above.
J85-J102	Query	***Intersection Pedestrian (Far–Sided Crossing Signals)*** *J85 This facility is a pedestrian crossing used at or closely linked to junctions which shall have far–sided crossing signals but shall not have call/cancel crossing demand but may have on–crossing pedestrian detection.* It is our understanding that the Methods of Control detailed within this subsection can only be applied to stand-alone pedestrian streams and not pedestrian phases at intersections. Also, the clauses J89 to J102 for Intersection Pedestrian (Far–Sided Crossing Signals) are very similar to J55 to J68 Toucan Stand-alone Far-sided Crossing Signals. Therefore for clarity, we recommend that the following words (based on J8) be added to clause J85: *Pedestrian Crossings with Far-Sided Signals that are closely linked to junctions, but are controlled as separate stand-alone facilities, require the same sequence and timing ranges as Far-Side Toucan Crossings, see clause J53.* Clauses J89 to J102 should be replaced by words similar to those in J103-J108 on Intersection Puffin for example.

TR2500	Compliance	Comment
		In our implementation, stand-alone far-sided pedestrian facilities will operate as for the far-sided stand-alone toucan. Intersection pedestrian signals will follow the intersection Methods of Control. Reviewed with David Overton (HA Representative) on 26/27 April 2006. Our concerns are understood, but there is a reluctance to change the specification as suggested since it is believed it may be intended to cover both intersection pedestrian phases and stand-alone streams close to the intersection.
J103 (J109) (J115)	Clarification	***Intersection Puffin*** *J103 The signal sequence and requirements for an intersection Puffin shall be as per a stand–alone Puffin, as detailed in clauses J37 to J52* ***Intersection Toucan (Far–sided Crossing Signals)*** *J109 The signal sequence and requirements shall be as for a stand–alone Toucan, as detailed as clauses J53 to J68.* ***Intersection Toucan (Near–sided Crossing Signals)*** *J115 The signal sequence and requirements shall be as per a stand–alone Toucan, as detailed in clauses J69 to J84.* Our interpretation is that the intersection pedestrian facilities only need meet the appropriate Pedestrian to Vehicle Intergreen Periods clauses from these earlier subsections, and not the Fixed Vehicle Period, VA and Linked Methods of Control, All-Red Quiescent State and the Vehicle to Pedestrian Intergreen clauses. We believe it is not possible, nor required, to attempt to run Fixed Vehicle Period Method of Control for example for a pedestrian phase that is part of an intersection stage stream. We would therefore recommend that the specification be modified to reflect this. David Overton (HA Representative) on 26/27 April 2006 agreed to consider adding 'as appropriate' for example to these clauses.
J104 J105	Compliant	
J106 (J114) (J120)	Query	***Intersection Puffin*** *J106 Where on–crossing detection is not provided, the All–Red period 6 shall be pre–set at a value within the range between 0–30 seconds, adjustable in 1 second steps.* ***Intersection Toucan (Far–sided Crossing Signals)*** *J114 Where on–crossing detection is not provided, the All–Red period vi, shall be pre–set at a value within the range between 0–30 seconds, adjustable in 1 second steps.* ***Intersection Toucan (Near–sided Crossing Signals)*** *J120 Where on–crossing detection is not provided, the All–Red period VI, shall be preset at a value within the range between 0–30 seconds, adjustable in 1 second steps.* Firstly, we believe there is typo in J114; it should be 'blackout period' and not 'All-Red period'. [Agreed with David Overton (HA Representative) on 26/27 April 2006] In our implementation, where on-crossing detection is not provided, the minimum All-Red or Blackout period (e.g. period 5) can be set to larger values to provide the required fixed clearance period. We recommend that the other periods be set to zero. This provides the user with one single timing value to control the fixed clearance period, which is the same fixed timing period used on the old standard Intersection Pedestrian phase. If the extendable clearance period (period 6 or vi) is used to set the fixed clearance period, then fixed clearance period is the summation of three timing periods, which we believe could lead to some confusion.

TR2500	Compliance	Comment
J107 (J112) (J118)	Clarification	***Intersection Puffin*** *J107 A pedestrian phase may run more than once within a stage.* ***Intersection Toucan (Far–sided Crossing Signals)*** *J112 A Toucan phase may run more than once within a stage.* ***Intersection Toucan (Near–sided Crossing Signals)*** *J118 A Toucan phase may run more than once within a stage.* In our implementation, the default operation is that the pedestrian phase only appears once, and remains at right of way until the stage terminates like all other phases within the same stage. If explicitly requested in the Works Specification, the controller can provide the facility to terminate a pedestrian phase after its minimum green time has expired, with an option for the pedestrian phase to appear at right-of-way again within the same stage.
J108	Compliant	
J109	-	See comments against Clause J103 above.
J110	Compliant	
J111	Compliant	
J112	-	See comments against Clause J107 above.
J113	Compliant	
J114	-	See comments against Clause J106 above.
J115	-	See comments against Clause J103 above.
J116	Compliant	
J117	Compliant	
J118	-	See comments against Clause J107 above.
J119	Compliant	
J120	-	See comments against Clause J106 above.
J121	Compliant	
J122	Compliant	
J123	Clarification	Our interpretation of this clause is that a latched pedestrian demand must be inserted when a pushbutton demand is detected without its associated kerbside detector going active, even if other kerbside detectors are active and this is the basis of our implementation. We recommend that the text be clarified; otherwise, it can easily be read that a demand is latched only when **all** kerbside detectors are inactive, which we believe does not meet the intention of the requirements. Modify J123 to read: *a) when both a push button box and ~~an~~ its associated kerb side detector demand exist simultaneously an unlatched demand shall be registered. Once registered, the demand shall remain registered while ~~a~~ any kerb side demand persists for the phase, irrespective of the state of the push–button demand. The registered demand shall be removed either upon expiry of all kerb side detector extensions and then the registered demand extension, or on commencement of the pedestrian phase green; or* *b) when a push button box demand exists but ~~an~~ a demand from its associated kerb side detector ~~demand~~ does not exist, a latched demand shall be registered. Once registered the demand shall remain registered and shall be removed on commencement of the pedestrian phase green.* Agreed with David Overton (HA Representative) on 26/27 April 2006 to reword as above (or similar) to make it clear in that: a) the demand is held until all kerbside demands for the phase have expired, and b) a latched demand is inserted even if a kerbside associated with the same phase is active, but the kerbside associated with the pushbutton is not.

TR2500	Compliance	Comment
J124	Query	*J124 Each registered demand (push button or kerbside) shall have an extension which shall be preset at a value in the range between 0 and 5 seconds, and adjustable in incremental steps of no more that 0.2 seconds* We believe this clause is based on words from section 7.3.3 of TR2210A, and therefore believe it is subtly incorrect and should be changed to read, "Each push button demand, kerbside demand and registered demand shall have an extension…" Our interpretation is that all three features must have their own extension facilities, as previously required by TR2210A and this is basis of our implementation. Agreed with David Overton (HA Representative) on 26/27 April 2006 that the Registered Demand Extension is a separate time period, after all the kerbside demand extensions have ceased, but we are not sure why this is needed. Action David to determine whether the feature should be included in TR2500 (updating J124) or all references to it should be deleted (e.g. in J123 and others?).
J125	Query	***On–crossing Extension Demands*** *J125 The controller shall receive inputs from the on–crossing detection system and provide the variable All–Red period of the pedestrian to vehicle phase intergreen.* Our interpretation is that "variable All-Red period" should read "extendable red or blackout period". However, we recommend that this clause (and its title) be deleted since it duplicates information already contained within the descriptions of the various stand-alone facilities and could confuse the issue being in this section on pedestrian push-button demands. David Overton (HA Representative) on 26/27 April 2006 agreed to look at this clause, with a view to either rewording it or deleting it.
J126	Query	*J126 Demand Indicators* This title has been converted to a numbered clause in error. [Agreed with David Overton (HA Representative) on 26/27 April 2006]
J127	Compliant	
J128 J133	Clarification	*J128 The controller shall be designed to operate with audible and tactile signals meeting the requirements of TR 2508 and TR 2509. Audible and/or tactile signals may be provided to indicate the steady green man period. Audible signals shall not be used unless the red signal displayed to motorists is such that <u>all</u> vehicular movements are signalled to stop. Tactile signals may be used where the red signal displayed to motorists is such that <u>all conflicting</u> vehicular movements are signalled to stop.* *J133 During normal operation, under fault conditions, or with permitted operator intervention, the controller shall only present an output to an audible and/or tactile signal if all vehicle phases conflicting with the pedestrian phase are at red.* Our interpretation of these clauses is that Red Lamp Monitoring must be provided to confirm that enough vehicle red signals are illuminated and, if the audible and tactile signals are powered from the pedestrian green output, then no additional checks by the controller are required. In our implementation, both audible and tactile signals are usually powered from the pedestrian green output, via suitable transformers and power supplies. Thus, audible and tactile signals cannot activate unless the pedestrian phase is at green. For tactile signals, we believe this is all that is required, since no conflicting vehicular movements can be at right of way at the same time as the pedestrian phase is at green and the tactile signal is powered. Checksum protected timing information should ensure that the vehicle phases have reached red before the intergreen to the pedestrian phase allows it to appear at green and for the tactile signal to activate. In addition to this for audible signals, the configuration would be visually checked to ensure all traffic phases are configured as conflicting so that none can be at right of way when the pedestrian phase is at green and the audible signal is powered.
J129- J132	Compliant	
J133	-	See our comments on clause J128 above.

TR2500	Compliance	Comment
J134	Clarification	***Single Vehicle Red Lamp Failure*** *J134 If called for in the Works Specification, a single vehicle red lamp failure, shall, within one signal cycle of the failure, cause the All–Red period of the relevant intergreens to be extended up to a value of 5 seconds, unless it is already 5 seconds or greater when no action will be taken.* In our implementation, the confirmation of a first red lamp failure on a phase can be configured to increase the intergreen from that phase to a conflicting phase by a preset value as requested by some customers. Thus, it allows the Works Specification to decide by how much to extend each intergreen (and therefore the all-red period) to allow the greatest flexibility. The all-red period is not explicitly limited to 5 seconds by the controller.
J135	Query	***Second or Total Vehicle Red Lamp Failure*** *J135 Upon the event of a second vehicle red lamp failure on the same phase, vehicle red lamp feed failure or failure of the vehicle red lamp monitor, the following actions shall be taken:* We note that this clause no longer indicates that Red Lamp Monitoring is only required at intersections with pedestrian audible or tactile signals, implying that all intersection streams with pedestrian phases must include Red Lamp Monitoring. ***This is a significant change in the requirements which we believe needs to be highlighted to all customers and manufactures.*** In our implementation, Red Lamp Monitoring can be enabled or disabled as required, regardless of whether pedestrian audible or tactile signals are to be fitted. Reviewed with David Overton (HA Representative) on 26/27 April 2006: The RLM facility must be available if pedestrian facilities are used at junctions. Therefore the wording is correct; no change to TR2500 required.
J135 CONTINUED	Query	Our implementation is that the response time for confirming red lamp faults is 500ms unless the failure occurs before or within 500 ms of the start of the monitored vehicle red, in which case action shall be taken within 1 second of the start of the red [based on the words in TR2210A section 9.11.4.3]. Agreed with David Overton (HA Representative) on 26/27 April 2006 that the following words (similar to those in D9-D11) should be added to J135: “Confirmation of the failure must occur within 500ms of the fault, unless the failure occurs before or within 500 milliseconds of the start of the monitored vehicle red. In this circumstance, action shall be taken within 1 second of the start of the red.”
J136	Compliant	
J137	Clarification	*J137 If the failure occurs during the pedestrian blackout period, the blackout shall terminate at the end of its period.* Our interpretation is that this clause also applies to the extendable all-red period of nearside pedestrian signals, as well as pedestrian blackout periods, and this is our implementation. Agreed with David Overton (HA Representative) on 26/27 April 2006 to reword this clause as follows: *“If the failure occurs before or during the Pedestrian to Vehicle Phase Intergreen, this shall continue as normal; it should not be terminated early.”*
J138	Compliant	

TR2500	Compliance	Comment
J139 J140	Query	***Restoration of Facilities*** *J139* *Following the shut down of a facility the facility shall not be restored until the fault has been rectified and the controller reset. This may be achieved either manually or by automatic reset, as called for in the Works Specification. Where action has been taken that affects pedestrian facilities, either at junctions or stand–alone, then the controller will have to be manually reset.* *J140* *In either case the controller shall go through a controlled start–up sequence (see clauses 3.3 to 3.5).* Our implementation is as follows: When pedestrian phases have been inhibited and not extinguished, lamp faults can be configured as either manual or automatic clearance. Regardless of how the fault is cleared, when the fault is cleared the controller will continue to operate normally with the pedestrian phases now permitted to gain ROW; it will not automatically initiate the start-up sequence. Where streams have been extinguished by a red lamp fault, manual clearance of the fault will always be required. This because the red lamps (along with all the other signals) have been extinguished so the controller cannot detect when the red lamp faults have been rectified. Following manual reset, the signals will resume via the start-up sequence. Also agreed with David Overton (HA Representative) on 26/27 April 2006 to reword these clauses along these lines: We liked this: *"Restoration of facilities may be achieved either manually or by automatic reset, as called for in the Works Specification."* Is this a real requirement *"Where action has been taken that affects pedestrian facilities, either at junctions or stand–alone, then the controller will have to be manually reset"*, since customers would prefer not to have to manually reset the fault (and run the start-up sequence) when the intersection is still running, but only the ped is inhibited. Should this be in TR2500 or in an advice note? Clause J140 should be deleted since part-time facilities are not covered by Appendix J therefore the start-up sequence should never be needed.
J141	Compliant	
J142	Compliant	
(J143)	Query	***Restoration of Facilities*** *Facilities shall not be restored until the fault has been rectified. The controller will need to be manually reset.* Note: Missing clause number. Compliant otherwise. [Agreed with David Overton (HA Representative) on 26/27 April 2006]
		TR2500 Appendix K – User Interface
K1 K2	Noted	
K3 K4	Noted	We have approval for our intersection and stand-alone controllers against Appendix K User Interface and we self-certify that our controllers meet this Appendix as written, except where noted in this document.
K5 K6	Noted	
K7	Clarification	*K7* *Access is for modifying non safety data as defined in tables 1-4* ***which can be modified either by local handset or remote access.*** *It shall be possible to monitor, but not modify, facilities restricted to level 3 access.* Our interpretation of this clause is that remote access should be permitted, but that it is acceptable that additional equipment may be required, such as a remote monitoring outstation (OMU). Remote handset access does not have to be available within the basic traffic controller.

TR2500	Compliance	Comment
K8 K9	Clarification	***Level 3*** *K8 Access is for modifying safety data as defined in tables 1-4.* ***Level 4*** *K9 Access to data appertaining to Traffic Safety Data (BS 7987 3.2.5.2) (site configuration parameters) shall not be changeable on-site or via levels 1, 2 or 3.* In our implementation, all data will be held in a battery supported RAM device or a FLASH / EEPROM type of device. Level 4 data will be held in a separately checksum protected area from data assigned Level 2 & 3. This checksum cannot be re-computed during normal operation. Thus, if Level 4 data is modified or corrupted, a checksum error will be detected. See also our General Query #2.3 on page 8. Also note that the reference to section 3.2.5.2 should be 3.2.5.1 for the definition of 'Traffic Safety Data'.
K10	Compliant	***Level 5*** *K10 Access to changes to the basic program. Such facilities will require the agreement of the Type Approval Authority.* Siemens does not give authority to other parties to modify the controller software. All software used in the controller has been tested and released by Siemens. As required by Self-Certification Procedures in TRG0600A only if the changes we make to the controller could affect conformity to the specifications must we obtain agreement from the Approval Authority. Therefore, Siemens are free to make minor updates to the controller firmware without agreement of the Approval Authority if they do not affect conformity to the specifications, and self-certify those changes: ***Modifications to Approved Products*** *3.15 Should the Design Authority wish to modify an approved Product that affects the functionality, construction or operation, they shall:* *i) Test both the retained and new functionality;* *ii) Update the Technical File;* *iii) Submit a new Declaration of Conformity.* Installing released software: For the ST900/ST750 controller families, the new software can only be installed by visiting the site and replacing the firmware PROM device or whole PCB module. For the ST950 controller family, at the request of some customers, the controller software can be updated over an IP connection. This software upgrade package is digitally signed by Siemens. However, even this upgrade procedure cannot modify the software running in the devices performing safety checks without a user being on-site.
K11	Compliant	
K12	Compliant	
K13	Compliant	
K14	Query	*K14 The terminal device will normally be associated with the display and modification of data concerned with the parameters listed in tables 1-4. Other parameters may be provided and these shall be allocated to either Level 2 or 3 by agreement with the Approval Authority.* Given that all the safety timing parameters are listed in this Appendix and are given an access level, we do not intend to request agreement from the approval authority what access level is given to any other parameters. We therefore recommend that this sentence is removed from the specification.
K15	Compliant	

TR2500	Compliance	Comment
K16 K17	Clarification	*K16* *Facilities may be provided either independent of the User Terminal, by the User Terminal or in parallel with the user terminal.* *a) Watchdog timer expired.* *b) Sum check error.* *c) Phases currently running and aspects being driven (these may be left on whilst the signals are off to aid controller checking).* *d) Indications and a means of selection to observe the current status of phase timers, (i.e. timing / not timing) for the following: i) minimum; ii) maximum; iii) intergreen; iv) extension.* *e) Detector input states;* *K17* *Visual indicators may be provided to display facilities (a), (b) and (c).* Our interpretation of these clauses is that indications can be provided either on the User Terminal (i.e. handset) **OR** by visual indications (i.e. LED's) as the manufacturer sees fit and this is the basis of our implementation.
K18	Clarification	***Timing Tolerance*** *K18* *The total timing tolerance of the controller can be considered in various categories, these categories are related to the various parameters by means of the timing charts.* *Category* *A – Tolerance ± 250 milliseconds* *B – Tolerance ± one second* *C – Tolerance ± 1 minute* *D – Mains Sync ± one second in 30 days or Crystal Clock ± one second in 24 hours* *E – Tolerance ± 10 minutes* We do not recommend the use of a Crystal Clock with CLF Plans (implied by the specification). We would always recommend the use of the Mains Frequency Synchronised clock and this is the default operation of our controllers. If requested in the Works Specification, the controller can be fitted with and synchronised to an external timing source, e.g. GPS Clock, and then configured (using a handset command) to use its crystal synchronised clock.
K19	-	*K19* *For the parameters in Table 2 the timing tolerance shall be as specified in that table. All parameters in Tables 3 and 4 shall have tolerance category A.* Refer to our comments below against the tables.
K20	Clarification	***Engineer's Control Facilities*** *K20* *Control facilities located inside the controller case shall be incorporated as manual switches and/or as part of the user terminal interface for use by engineering personnel.* Our interpretation of this clause is that such facilities may be provided using either manual switches [or pushbuttons for example] **OR** as part of the user interface [i.e. handset serial port] as the manufacturer sees fit.
K21	Clarification	*K21* *A switch shall be provided to immediately remove the signal light source supply and audible/tactile supplies without interfering with the supply to the controller operating circuits. When the signals are switched on again the controller shall operate in the start-up sequence described in Chapter 3 of this specification.* At the request of some UK customers, the signals on/off switch in our implementation can be configured to switch the signals back on immediately in their current state (although we do not recommend it) rather than introduce the start-up sequence.
K22	Query	Note minor typing error; Clause K22 refers to a 'police panel'. We believe this means the 'manual panel'. [Agreed with David Overton (HA Representative) on 26/27 April 2006]
Table 1	Compliant	

TR2500	Compliance	Comment

Table 2
Table 3
Table 4

Query

Range and Step Size

Our interpretation is that the range and step size quoted in tables 2 to 4 represent the minimum facilities that are acceptable, as implied by the words in section 11.1 of TR2210A. In our implementation, we will allow a range of values larger than that required by the tables in many cases, subject to configurable range limits on the safety timings identified in section 9.16 of TR2210A (see below).

We would therefore recommend that the following words (based on 11.1 of TR2210A) be added near clause K14:

"The range and step size quoted in the timing tables 2 to 4 and elsewhere in TR2500 represent the minimum facilities which are acceptable. A manufacturer at his discretion may provide more comprehensive facilities."

We also notice that the words below from TR2210A do not appear in TR2500, and without them, the above proposed words would permit no range checking whatsoever. We therefore recommend that the words below based on TR2210A 9.16 be also added near clause K14.

9.16 Adjustment of Safety Timings

It shall be possible, without access level 4, only to adjust controller parameters subject to the following constraints:

a) a phase minimum running period shall not be set below a configured minimum green limit value;

b) a phase intergreen shall not be set below a configured intergreen limit value;

c) the stand–alone vehicle minimum running period shall not be set below six seconds;

d) the stand–alone vehicle red/green walking man shall not be set below four seconds; and

e) the stand–alone vehicle red/red standing man shall not be set below one second.

It shall not be possible to adjust the minimum green and the intergreen limit values without access level 4.

If an attempt is made to modify any timing to a value that conflicts with the timing constraints specified in this clause, no change shall be made to the timing.

Table 2
Table 3
Table 4

Query

Extension Times

The tables require that vehicle extension times and pedestrian / puffin / toucan on-crossing extension times are assigned access level 3, whereas pushbutton and kerbside demand extensions are assigned access level 2:

Vehicle extension	*0.2 – 5 sec*	*0.2 sec*	*A*	**3**	*ALT*
Pushbutton operation	*1 – 5 sec*	*0.2 sec*	*A*	**2**	*ALT*
End of kerbside detection	*1 – 5 sec*	*0.2 sec*	*A*	**2**	*ALT*
Other registered demand	*1 – 5 sec*	*0.2 sec*	*A*	**2**	*ALT*
Red or Blackout Extension (period 6)	*0.4 – 5 sec*	*0.2 sec*	*A*	**3**	*ALT*

Firstly, in our implementation one handset command (**IPX**) is used to set the extension period applied to any type of **detector input**. We believe this makes our controllers easier to use. However, it means all the above timings have to be given access level 3.

Secondly, an alternate handset command (**EXT**) has been available for some time to set the extension period applied to a **vehicle phase**, and this handset command is and has historically always been access level 2.

Table 2

Query

Start-Up Sequence 'All Off' Period

'All Off' period following power up	*7 – 60 sec*	*–*	*N/A*	*4*	*Fixed*
'All Off' period following manual switch on	*0 sec*	*–*	*N/A*	*4*	*Fixed*

We would recommend that the 'range' for the 'manual switch on' entry be changed from "0 sec" to "7 – 10 sec"; see our comments against Clause 3.3 of TR2500A.

TR2500	Compliance	Comment
Table 2	Query	**Push-Button and Kerbside Extensions** We believe the wording below from the table may be misleading: *Hold demand after:* *Push button operation* — *1 – 5 secs* — *0.2* — *A* — *2* — *ALT* *End of kerb side detection* — *1 – 5 secs* — *0.2* — *A* — *2* — *ALT* *Other registered demand* — *1 – 5 secs* — *0.2* — *A* — *2* — *ALT* For example, the demand **for the phase** is not held after the pushbutton operation, but after the kerbside goes inactive. Also, what is meant by 'other registered demand'? *Push button ~~demand~~ extension* — *1 – 5 secs* — *0.2* — *A* — *2* — *ALT* *Kerb side detection ~~demand~~ extension* — *1 – 5 secs* — *0.2* — *A* — *2* — *ALT* *Registered demand extension* — *1 – 5 secs* — *0.2* — *A* — *2* — *ALT* For clarity, we would recommend that the above words from TR2210A be re-instated.
Table 3 Table 4	Clarification	**Fixed Vehicle Period Access Level** *Fixed vehicle period* — *ALL* — *20 – 60* — *4* — **3** — *ALT* *VA vehicle minimum* — *Pe, Pu* — *6 – 15* — *1* — 3 — *ALT* *VA vehicle minimum* — *Ped* — *3 – 15* — *1* — 3 — *ALT* *VA vehicle maximum* — *ALL* — *10 – 60* — *10* — **2** — *ALT* *Vehicle extension* — *ALL* — *0.2 – 5* — *0.2* — 3 — *ALT* In our implementation, the same handset command is used to control both the vehicle maximum and fixed vehicle period, as implied by clause J23 of TR2500A (below) and thus, this handset command has been assigned access level 2. *Fixed Vehicle Period Method of Control* *J23* *The vehicle phase green shall terminate on expiry of the vehicle maximum green time, with a pedestrian demand present. This time shall be preset at a value in the range between 20 and 60 seconds, and adjustable in incremental steps no greater than four seconds.* In our implementation, the controller stills runs the vehicle minimum green period (access level 3) such that the vehicle phase will not terminate until this has expired, even if the fixed vehicle period is set lower. We believe customers would want the ability to modify the fixed vehicle periods remotely, as they would the vehicle maximum and therefore have assigned it access level 2.
		TR2500 Appendix L – Speed Measurement
L1	Noted	We have approval for our intersection and stand-alone controllers against Appendix L Speed Measurement and we self-certify that our controllers meet this Appendix as written, except where noted in this document.
L2-L7	Noted	
L8	Query	*Speed Measuring Detectors* *L8* *The use of Speed Discrimination and Speed Assessment requires detectors installed in pairs **normally 3.66m (12 feet) apart**. The speed is measured from the time interval between the operation of the two detectors as a vehicle passes. The logic for this may be incorporated within the controller.* We would recommend that the text *"…normally 3.66m (12 feet) apart"* be added to the end of the first sentence in clause L8 as shown above, otherwise it is not possible for the controller to determine the vehicle speed for clause L12 Speed Assessment. Our implementation allows the configuration to specify either 10-foot or 12-foot loop spacing to allow for installations where the non-standard 10-foot spacing is used.
L9	Query	*L9* *The strategy for the implementation of speed measuring detectors is described in TA 12.* We have currently been unable to locate a copy of TA 12 since it is not available on-line from the TSS Plans Registry. Given this situation and that TA is only a 'traffic advisory' document, should it / can it be referenced from TR2500?

TR2500	Compliance	Comment
L10 L11	Compliant	
L12	Compliant	Also see our comments against clause L8 above.
L13	Query	*L13 Other algorithms may be used with the prior approval of the Approval Authority;* Given the move to self-certification and wording in clause L1: *L1 … Approval to this appendix requires the Design Authority to self-certify that the Product meets the requirements specified.* …we believe clause L13 has been copied along with the surrounding text from section 9.1.3 of TR2210A in error and should be deleted.
L14 L15	Compliant	
L16	Clarification	*Extra Clearance Period* *L16 A <u>two second extension</u> to the 'All-Red' period shall be automatically added following the running of any phase which is provided with speed assessment or speed discrimination equipments if any one of the following circumstances occur:* *a) any speed extension is curtailed;* *b) <u>any VA extension is curtailed</u>* *c) a speed discrimination or speed assessment extension occurs during the amber signal;* *d) during the phase green period, any vehicle detector connected to speed measurement equipment associated with that phase is not operated.* In our implementation, the duration of the Extra Clearance Period on an intersection stage-stream is configurable, including by a 'level 3' handset command (SCT), and therefore can be set to two seconds or any other required value. On a stand-alone stage-stream, an 'Extra Clearance Period' is not applied and instead the duration of all-red Period 3 is *'fixed at 3 seconds when speed measurement equipment is fitted'* as required by Clause J32 etc. In our implementation, (b) is a configurable option whether the extra clearance period is requested by the VA extension being curtailed.
L17- L20	Clarification	For our integral SDE/SA facility, testing can be performed using the handset (either locally or remotely) and a means to measure the vehicle speed, e.g. radar gun. The testing does not inhibit the operation of SDE/SA in any way and therefore artificial speed extension and extra clearance periods are not required.
		TR2500 Appendix M – Informative Guide
M1	Noted	
M2	Noted	At different customers' requests, different types of cabinet door locks are available.
M3	Query	***Compatibility*** *M3 If compatibility is required with existing UTC or MOVA equipment, a standard parallel interface to TR 2523 should be specified.* We recommend that this clause be reworded to include detection equipment that is also covered by TR2523: "*If compatibility is required with existing UTC, MOVA <u>or detection</u> equipment, …"*
M4 M5	Noted	
		End of TR2500

6. Compliance against TR2523

This section contains comments against the clauses in “TR 2523, Traffic Control Equipment Interfacing Specification, Issue A, September 2005”…

TR2523	Compliance	Comment
		TR2523 Section 1 – Introduction
1.1-1.3	Noted	
-	Query	*Section 2 – Controller Equipment Interfaces and Power Supplies* *Section 3 – Ancillary Equipment Interfaces and Power Supply Requirements* We are unclear as to why the detail of the interfaces and power supplies has been split between sections 2 and 3 and believe this has only lead to confusion and unnecessary duplication. We recommend that the two sections be merged.
		TR2523 Section 2 – Controller Equipment Interfaces and Power Supplies
2.1.1	Compliant	
2.1.2	Compliant	
2.1.3	Compliant	
2.1.4	Clarification	*2.1.4 The Bit Format shall be in accordance with the following: [7-E-1]* Our implementation also supports 8 Data Bits with No Parity as well as the required 7 Data Bits with Even Parity in order to support new communications devices such as Bluetooth.
2.1.5	Compliant	
2.1.6	Compliant	
2.1.7	Compliant	*2.1.7 The Character set shall be ISO Alphabet No. 5 (ASCII).* In our implementation, during exchanges with other Siemens equipment (or Siemens software running on a PC or PDA etc) connected to the user serial interface (i.e. handset port), alternate 8-bit ‘binary’ protocols may be utilised rather than ASCII ‘text’. However, the connection will always begin by accepting ASCII.
2.2.1	Compliant	
2.3.1 (2.3.10)	Query	*2.3.1 The parallel input interface is for connection of external ancillary equipment, e.g. pedestrian detectors, outstation transmission unit, MOVA units, etc.* *2.3.10 The interface requirements for outstation transmission units or MOVA units are defined in Section 4 Urban Traffic Control (UTC).* We draw attention to the apparent inconsistency of the above two clauses. We also believe that ‘vehicle detectors’ should be added to the list of examples. The parallel input interface in our implementation can be used for the connection of all equipment types listed.
2.3.2	Noted	
2.3.3	Clarification	*2.3.3 The detector influences an isolated relay contact (or solid state equivalent) that is normally a closed circuit (resistance no more than 180 ohms +5%) and only changes to an open circuit (resistance greater than 100K ohms) while a target object is being detected or the detector is powered down.* Our interpretation is that this clause is referring to above ground detectors since clause 2.3.7 states that below ground (loop) detectors indicate presence with closed circuit. In our implementation, controller inputs can be configured so either open circuit or closed circuit is treated as ‘presence’.
2.3.4	Compliant	

TR2523	Compliance	Comment
2.3.5	Clarification	*2.3.5 The logic '0' output state shall be assumed when the resistance across the terminals is 250 ohms 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 ohms).* Our controllers are functionally compliant with this requirement on the assumption that it is referring to connections to above ground detectors (i.e. following on from clause 2.3.3). The 'logic 0' state is assumed to mean the 'no detect' closed circuit state. This logical condition will be used by the controller, although the user interface may show the physical state of the input as a '1', which consistently indicates a closed circuit input.
2.3.6	Clarification	*2.3.6 The logic '1' output state shall be determined when the controller senses an open circuit represented by a high impedance greater than 100 K ohms.* Similar comments as for 2.3.5; assumed to be referring to the connection to above ground detectors, 'logic 1' is assumed to mean the 'detect' state. The user interface may show the physical state of the input as a '0', which consistently indicates an open circuit input / no connection.
2.3.7	Compliant	*2.3.7 Below Ground Vehicle Detectors to TR 2512 shall provide a 'normally open' output (resistance greater than 100k ohms), which changes to a closed circuit (resistance no greater than 180 ohms +5%) while a target object is being detected or the detector is not powered.* In our implementation, controller inputs can be configured so either open circuit or closed circuit (default) is treated as 'detect'.
2.3.8	Compliant	
2.3.9	Compliant	*2.3.9 Except where otherwise stated, the controller shall interrogate input signals at intervals of not greater than 40 milliseconds.* Our interpretation of this clause is that the controller needs to sample the inputs at this rate or faster in order to detect short activations. This requirement does not define the time the controller should respond to a change of state of the input. For example, the controller does not need to illuminate the pedestrian WAIT indicator within 40ms of the pushbutton being pressed.
2.3.10	Noted	See also our comments against 2.3.1 above.
2.4.1	Query	*2.4.1 The output from vehicle and pedestrian detecting equipment shall be an isolated output.* We believe this subsection details the outputs on the controller; not outputs on detectors, which were described in section 2.3.
2.4.2	Clarification	*2.4.2 For the isolated contact the logic '0' state on the controller output terminals shall continuously present a maximum resistance of 180 ohms + 5% and shall be able to withstand a current of at least 50 mA. The solid-state output shall continuously allow a current of 50 mA to pass with a volt drop of no more than 2.5 V.* Our controllers are compliant with the electrical details in this clause, however this describes the logic '1' energised state of 'normally open' controller outputs so that open circuit is presented with the idle logic '0' condition. We believe this is the idle safe state, particularly when these outputs are used by the UTC interface; the main use for controller outputs. Also see our comments against clause 4.2.4 on page 57.
2.4.3	Clarification	*2.4.3 The logic '1' state on the Controller output terminals shall continuously present a resistance of greater than 100 K ohms, and shall be able to withstand a continuous voltage of up to 75 V dc.* Our controllers are compliant with the electrical details in this clause, however this describes the logic '0' de-energised state of 'normally open' controller outputs; see our comments against 2.4.2 above.
2.4.4	Compliant	
2.4.5	Noted	
2.5.1	Compliant	

TR2523	Compliance	Comment
2.5.2	Query	*2.5.2 The Solar cell shall switch the supply voltage such than no mains voltage present on the Controller solar cell input shall be interpreted as bright and mains on the Controller solar cell input shall be interpreted as dim.* For all-ELV systems, the Solar Cell must also be an ELV and not a mains powered device. We therefore recommend that words such as 'mains voltages' be replaced by 'supply voltage' in this clause and this is our implementation.
2.5.3	Noted	
2.5.4	Noted	
2.5.5	Compliant	
2.6.1	Query	*2.6.1 Each signal phase drive equipment shall be capable of switching between 0.1A and 4A per phase colour at the normal mains voltage 230 V ac + 10% - 13%, (class A1) with an operating frequency range of 50Hz ± 4%. (Class F2). The switching devices are either volts free relay contacts or solid-state equivalent.* Refer to our comments on Class A1 (230V), Class F2 (50Hz) and Class K1 (4A) earlier in this document. For our ELV Controllers, the phase drive outputs supply an ELV compatible voltage rather than a mains voltage (230V) by definition. We are unclear as to why the words *"The switching devices are either volts free relay contacts or solid-state equivalent"* are included in this clause when by definition, the 'switches' can not be 'volts free' if they are to switch the mains supply to the signals! We believe this phrase may have been added in error and was intended for the digital I/O outputs, not the phase drive outputs.
2.7.1	Compliant	
2.7.2	Clarification	*2.7.2 The Signals Controller shall include an Auto transformer to provide the dimming voltage which shall be tapped to provide RMS voltages of 120 V ± 5 V, 140 V ± 5 V and 160 V ± 5 V at nominal supply voltage and full load conditions. Only one of these voltages will be connected at any one time. The normal dimmed voltage is 160 V and this shall be supplied unless otherwise requested.* Compliant for our mains drive outputs on mains controllers. For our LV Controllers with ELV outputs, the Dim Voltage is 32V nominal (32/48 is the same ratio as 160/240). For our newer all-ELV Controllers, the Dim Voltage is 27.5V nominal to be compatible with the specification CLC/TS 50509.
2.8.1	Clarification	*2.8.1 The supply for Audible and Tactical units may be derived from the Signal Aspect but shall be transformed to an ELV supply of 48V or less before it can be used in the Pedestrian pushbutton box.* In our implementation, Audible units will be supplied from the standard 9V to 30V DC 'interlock' supply, (which is already ELV), possibly derived from the signal aspect.
2.8.2 (3.8.4)	Query	*2.8.2 An interlock supply of 9 to 30 V dc shall be provided only when the Pedestrian signals are set to display a steady green and a minimum of one red signal aspect is displayed on each of the associated traffic signal phase.* *3.8.4 An Interlock shall be provided that corresponds to the Vehicle red signal monitor function such that the supply out shall be inhibited when a fault condition is present.* We believe this is a new requirement and we understand that it is not the intention of TR2523A to add a new requirement in this area. Previously the interlock was only used to disable the tactile and audible signals during a flashing green period, or to disable the audible at night for example. If the controller determined that red lamps are missing, then the requirements in TR2210A were (and in TR2500A still are) to inhibit the pedestrian phase or extinguish all signals so that the associated green signal aspect did not illuminate and therefore the audibles and tactile units would not activate. This mechanism did not rely on the interlock supply. We therefore believe that the specification should be modified to remove any mention of red lamp monitoring from these clauses on the interlock supply because red lamp monitoring directly affects the signal aspect supply, not the interlock supply.

TR2523	Compliance	Comment
		In our implementation, the interlock supply is not used to disable the audible and tactile signals when red lamps fail. The associated pedestrian green will be prevented from appearing at right of way as required by the red lamp monitoring requirements in Appendix J of TR2500A, effectively providing the necessary interlocking. Refer also to clause 3.8.4.
2.8.3	Compliant	
2.9.1	Compliant	
2.10.1 2.10.2 2.10.3	Clarification	***2.10 Vehicle and Pedestrian Detectors*** *2.10.1 A power supply of 500 mA or greater, protected by a suitably rated fuse or circuit breaker, shall be provided for detector equipment.* *2.10.2 The dc supply is 24 V dc ± 20%.* *2.10.3 The ac supply is 24 V ac RMS ± 20%.* In our implementation, in order to meet the ELV regulations, on our all-ELV controllers with a fully rectified lamp supply, the detector supply is also fully rectified AC (and the same polarity of the lamp supply) in order to stay within 50V of the lamp supply.
2.11.1	Query	***2.11 Nearside Signal, Demand Accepted Indicator*** *2.11.1 The operating voltage for these devices shall be 48 V ac.* No mention of dimming or any allowable range is provided for.
2.12.1	Clarification	***2.12 Regulatory Signs*** *2.12.1 A 230 V ac + 10% - 13% supply shall be provided with a separate fuse or circuit breaker.* In our implementation, this is available as standard on 230V intersection controllers, and available as an option on small stand-alone pedestrian controllers. For our all-ELV Controllers, this supply is also ELV, not mains.
		TR2523 Section 3 – Ancillary Equipment Interfaces and Power Supply Requirements
3.1.1	Noted	
3.1.2	Noted	Although we note MCH 1979 has not yet been issued and the draft distributed for comment is incorrect.
3.2 to 3.5 General Comment	Query	***3.2 Vehicle detectors – Above Ground (to TR 2505)*** *1.4* The power supply shall be 24 V ac ±20%.* ***3.3 Vehicle Detectors – Below Ground (to TR 2512)*** *3.3.1 The power supply shall be 24 V ac or 40 V ac + 13% - 10%.* ***3.4 Pedestrian Kerbside Detectors (to TR 2507)*** *3.4.1 The power supply shall be 24 V ac ± 20%.* ***3.5 Pedestrian On-Crossing Detectors (to TR 2506)*** *3.5.1 The power supply shall be 24 V ac ± 20%.* * Clause numbering error in TR2523A As detailed in section 2.10, the detector supply can be either AC or DC. The specification should therefore be corrected or this duplication of detector supplies should be deleted. In our implementation of all-ELV Controllers, the detector power supply is fully rectified AC in order to be compatible with the fully rectified lamp supply.
3.3.1	Query	***3.3 Vehicle Detectors – Below Ground (to TR 2512)*** *3.3.1 The power supply shall be 24 V ac or 40 V ac + 13% - 10%.* Since these AC supplies are usually obtained directly from the 230V AC supply via an isolating transformer, it is not practical to restrict the tolerance to the same as those allowed for the 230V supply and allow nothing for the transformer. Our interpretation is that the tolerance is ±20% for all detector supplies, as detailed in 2.10.3 (defining the supply from the controller) and 3.2 (for above ground detectors), and we believe the specification should be corrected.

TR2523	Compliance	Comment
3.3.2	Clarification	*3.3.2 The detector units shall be connected using either:* ♦ *An RJ 45 Connector;* ♦ *Euro Connector; or* ♦ *Integrated Detector Link.* In our implementation, we will support at least one of these standard interfaces (detailed in TR2512) as we see fit. Initially, this will be the standard Euro connector, but in the future we may replace this with either a RJ 45 serial connector or integrated detector link.
3.3.3	Compliant	
3.4.1	Clarification	***3.4 Pedestrian Kerbside Detectors (to TR 2507)*** *3.4.1 The power supply shall be 24 V ac ± 20%.* Refer to 3.2 above.
3.4.2	Compliant	
3.4.3	Compliant	
3.4.4	Compliant	However, we would recommend that the additional details on the test pulse for piezoelectric detectors from section 7.6.1 of TR2210A be added to clause 3.4.4 to avoid the information being lost.
3.5.1	Clarification	***3.5 Pedestrian On-Crossing Detectors (to TR 2506)*** *3.5.1 The power supply shall be 24 V ac ± 20%.* Refer to 3.2 above.
3.6.1	Query	***3.6 Nearside Signal and Demand Units (to TR 2511)*** *3.6.1 Operation at a reduced intensity is a requirement for the nearside signal unit. When required the light output shall be at 15 to 25% of its full brightness. The reduced voltage levels shall be as detailed in 2.7.* The requirement that dimmed signals should show 15 to 25% is in TR2511 and should not be repeated here. The reduced voltage levels detailed in 2.7 only covers 160V (etc) and not the ELV supplies that are required by nearside signals. It is our recommendation that the nearside dimmed supply voltages be added to clause 2.11 (see above) and therefore that clause 3.6.1 be deleted.
3.6.2	Noted	*3.6.2 Nearside signal units can comprise of:* ♦ *One unit housing both nearside signal and demand unit, or* ♦ *Separate nearside signal and demand units* We believe these requirements are detailed elsewhere and need not appear in TR2523.
3.6.3	Compliant	
3.7.1	Query	*3.7 Pedestrian Audible Units (to TR 2509)* *3.7.1 The tactile interlock power supply shall be as detailed in 2.8.2. The audible unit shall not draw more than 12 mA from this supply.* We believe this clause should read 'the audible power supply'.
3.8.1	Clarification	*3.8 Pedestrian Tactile Units (to TR 2508)* *3.8.1 For a power supply internal to the signal controller, the power supply shall be derived from, or controlled by, the signal controller's supply to the green pedestrian signals.* Our interpretation of this clause is that the power supply ***for the tactile units*** must be derived from the pedestrian green signal.
3.8.2	Noted	

TR2523	Compliance	Comment
3.8.3	Query	*3.8.3 A supply of 15 to 30 V dc shall be provided for the tactile unit. The **audible unit** shall be limited to 12 mA from this supply.* Our interpretation of this clause is that it is describing the tactile interlock supply, and not the power supply to the tactile units and the specification should be reworded to clarify this. There is also a typo in the second sentence; it should read 'tactile unit' not 'audible unit'.
3.8.4	Query	*3.8.4 An Interlock shall be provided that corresponds to the Vehicle red signal monitor function such that the supply out shall be inhibited when a fault condition is present.* We believe this is a new requirement – see our comments against clause 2.8.2.
3.9.1 3.9.2	Clarification	***3.9 Accommodation of Ancillary Equipment*** *3.9.1 A mounting rack of full or half width to IEC 297 Standard (w483mm × h222mm × d306mm) shall be provided within the controller. The depth of 306mm does not include an additional provision of 26 mm in front of any ancillary equipment.* *3.9.2 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.* Compliant in our standard 'large' cabinets using a 'swing frame'. The provision of such a 5U mounting rack is not available in all types of cabinet, particular small cabinets preferred by some customers for some applications, such as stand-alone pedestrian controllers.
		TR2523 Section 4 – Urban Traffic Control (UTC)
4.1.1	Compliant	
4.1.2	Noted	
4.1.3	Noted	
4.1.4	Compliant	
4.1.5	Clarification	*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.* Our interpretation is that Option 1 is often referred to as 'UTC Type 106', and Option 2 is referred to as 'UTC Type 316'.
4.1.6	Compliant	
4.1.7	Noted	
4.1.8	Noted	
4.1.9	Compliant	
4.2.1	Noted	
4.2.2	Noted	
4.2.3	Query	***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.* In our implementation, our controllers can be configured to operate this way, but it is not the default (see the following clause).

TR2523	Compliance	Comment
		We also draw your attention to a possible problem with the interface. If the UTC Interface is disconnected, then all controller input terminals will be open circuit leading to all control signals going active, including all force bits and demand bits! We would therefore recommend Method 2 always be used.
4.2.4	Query	*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.* In our implementation, this is the default operation of our controllers: an active force bit (e.g. stage requested) is the closed circuit condition across the controller input terminals and an active reply bit (e.g. stage running) is the open circuit conditioning across the controller output terminals. Thus, a disconnected UTC interface will naturally not demand a stage but indicate all stages running (including G1/G2), which immediately indicates a problem as required by clause 4.5.6e. The phrases 'logic 0 condition' and 'logic 1 condition' used in this clause seem to contradict the use of 'active state' and 'idle state' within the clause. It could therefore be read that these phrases are superfluous, but they are too similar to the phrases 'Condition 0' and 'Condition 1' used elsewhere in the specification, including in the definition of Method 1. We therefore recommend that these phrases are modified as follows: *a) a logic **condition '1'** 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 **condition '0'** 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.* In our implementation, the user terminal will display of the physical state of a digital output which may not match the UTC 'logic condition' states described in this clause. Generally, the state of a physical output displays a '0' when the output relay is not energised, regardless of what that the output is used for.
4.3.1	Compliant	
4.3.2	Clarification	Control and Reply bits of our integrated OTU can be passed through the Controller I/O to external equipment.
4.3.3	Clarification	*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.* In our implementation, all control and reply bits used by the controller must be specified in the Works Specification prior to the controller being configured. New or different control and reply bits cannot be configured between the Controller and OTU using the handset. The Controller must be reconfigured in order to specify the function of the control or reply bit, e.g. which stage it is to force.
4.4.1	Compliant	
4.4.2	Compliant	
4.4.3	Compliant	

TR2523	Compliance	Comment
4.4.4	Clarification	*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.* In our implementation, all the control bits of the UTC interface must be specified in the Works Specification. There is a one-to-one connection between the Controller's I/O UTC Interface and the OTU's Control/Reply I/O Interface to reduce the likelihood of errors during installation. Our controllers are not configured with all possible UTC control bits available on a large number of, usually unused, digital inputs. Therefore, DX will only be available if it is specified in the control words of the Controller's UTC interface. It is therefore up to the customer to specify whether a DX control bit is required on this interface (and which phases it is to demand). It is of course possible to add a DX bit (or a number of DX bits) to any of our controllers.
4.4.5	Compliant	
4.4.6	Compliant	
4.4.7	Clarification	*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.* In our implementation, which phases are demanded and/or extended by a DX bit is configurable, as required by 4.4.3. Only if the DX bit is configured to demand and extend all phases will all phases and stages run in cyclic order and to their maximums.
4.4.8	Compliant	
4.4.9	Compliant	
4.4.10	Compliant	
4.4.11	Compliant	
4.4.12	Compliant	
4.4.13	Compliant	
4.4.14	Compliant	
4.4.15	Compliant	
4.4.16	Compliant	
4.4.17	Clarification	We interpret these as the normal rules for a VA demand and extend request.
4.4.18	Compliant	We believe the references to clauses 4.2 and 4.3 are incorrect and should just refer to clause 4.1.9 (as implied by the equivalent clause in TR2210A)
4.4.19	Compliant	
4.4.20	Compliant	
4.4.21	Compliant	
4.4.22	Clarification	*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'.* In our implementation, a facility is provided that disables the UTC mode of operation if any Force Bit remains active for longer than a configurable time. The default time is 200s. The time can be changed using the handset in 10-seconds steps in the range 10 to 2540 seconds to allow complete flexibility, or the facility can be disabled. UTC mode is permitted again when the force bit is confirmed as inactive. Manual intervention is not required. However, the fault flag remains set until manually cleared. The check is automatically disabled if our semi-integral MOVA unit is used. However, the controller has no way of knowing whether an external TO bit input is connected to an OTU or MOVA unit. Therefore, the check cannot be automatically disabled if the TO bit is active. In this case, the check must be manually disabled.

TR2523	Compliance	Comment
4.4.23	Compliant	
4.4.24 4.4.25 4.4.26	Compliant Compliant Compliant	***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.* In our implementation, a 'Switch Facility' can be configured to perform a wide range of tasks via our Special Conditioning facility. Restrictions on when the Switch Facility should cause an action, such as those mentioned above, can be implemented but must be specified in the Works Specification if they are required.
4.4.27	Query	*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.* Our implementation is based on our interpretation of this clause that it is referring to a digital output from the controller that may be used to switch a sign, where condition '1' represents the open circuit condition across the controller output terminals (see clause 4.2.3). We believe it cannot be referring to the SF1 control bit digital output from the OTU since condition '0' should be the idle state and this should be the state all control bits revert to under most fault conditions. For example, if the OTU loses communications, how is it to know that this particular control bit should be '1' when all the others should be '0'? We therefore recommend that the specification be modified.
4.4.28	Compliant	
4.4.29	Clarification	***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.* In our implementation, the controller includes an enhancement that inhibits vehicle extensions (for a short configurable period) when the PV signal ceases such that the vehicle stage is terminated in favour of serving a pedestrian (or cycle, etc.) demand if one is present, regardless of vehicle extensions. If this feature is not required, the configurable time period can be set to zero, in which case the demand is serviced in the normal manner as stated in 4.4.29. This 'enhancement' is not mentioned in this clause, but is required by some of our customers.
4.4.30	Compliant	
4.4.31	Compliant	
4.4.32	Compliant	
4.4.33	Query	*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.* Our interpretation of this clause is that synchronisation must occur ***'within 1 second'*** of the start of the '0' to '1' transition. The '±5%' is superfluous.

TR2523	Compliance	Comment
4.4.34	Clarification	*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.* Since synchronisation is required to occur at the start of the second '1', the controller has to synchronise before it can confirm the duration of the second '1'. It can only confirm that the second '1' has really started by making at least two successful scans, as required by clause 4.1.9. Thus in our implementation, the controller checks the duration of the first '1' (and indirectly checks that the control bit was zero before it) and the duration of the '0'. It cannot confirm the duration of the second '1', only that it is a valid transition to the '1' state.
4.4.35	Clarification	*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.* The title of this control bit appears to have been changed, from "Lamps On/Off (LO)" in TR2210A. Assuming this is a typing error, our controllers are compliant. In our implementation this 'Lamps On/Off' facility is usually configured to function in parallel with other requests for part-time operation. To allow full flexibility, it is implemented using special conditioning and so the time delay of 10 seconds can be implemented if specified in the Works Specification.
4.4.36	Clarification	*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.* To allow complete flexibility, our implementation of this facility uses Special Conditioning.
4.4.37	Compliant	
4.4.38	Query	*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.* Same comment as on clause 4.4.34 above. We also suggest that the phrase 'lasts for less than one second' is replaced by the phrase 'is not 1 second ±400 ms' – a controller must not reject the sequence if one of the bits only appears for 999ms!
4.4.39	Compliant	
4.4.40	Compliant	
4.4.41	Compliant	
4.4.42	Compliant	
4.4.43	Compliant	
4.4.44	Clarification	*Close Car Park (CP)* *4.4.44 Logic condition '1' shall close the car park.* Our interpretation is that this clause only requires the controller to examine the control bit and accordingly control a digital output or signal aspect drive to a sign for example.
4.5.1	Compliant	
4.5.2	Noted	
4.5.3	Noted	
4.5.4	Noted	
4.5.5	Compliant	
4.5.6	Compliant	

TR2523	Compliance	Comment
4.5.7	Clarification	*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'.* In our implementation this reply bit output must use a normally closed relay contact in order to indicate condition '0' when the controller is switched off, and outputs of this type are available on our controllers.
4.5.8	Compliant	
4.5.9	Compliant	
4.5.10	Compliant	
4.5.11	Clarification	*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.* The HC reply bit provided as standard by the controller firmware is active during only the hurry call hold period, i.e. while it 'is being actioned'. If the bit is requested to be active at other times in the Works Specification, this can be achieved using Special Conditioning.
4.5.12	Compliant	
4.5.13	Clarification	*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.* In our implementation this reply bit output must use a normally closed relay contact in order to indicate condition '0' when the controller is switched off, and outputs of this type are available on our controllers.
4.5.14	Clarification	(Same note as for 4.5.13 above)
4.5.15	Compliant	
4.5.16	Compliant	
4.5.17	Clarification	*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.* In our implementation we provide the following standard reply bits: 'GR1' is active for the complete duration of the first CLF group, which is typically longer than three seconds, and 'CYC' is active for the first three seconds of the CLF cycle, which is not necessarily when the first group is running. The configuration data specifies the time within the cycle when the first group is to start. The first group therefore does not have to start at the beginning of the CLF cycle.
4.5.18	Compliant	
4.5.19	Clarification	In our interpretation, a built-in reply bit (called RR) is available that provides either the required MC or RR functionality. If both bits are required in the Works Specification, Special Conditioning can be used to create both or one of the bits.
4.5.20	Compliant	
4.5.21 4.5.22 4.5.23	Query	*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.* We believe this clause has been split in error, and our interpretation is based on the original layout of the text in TR2210A which follows:

TR2523	Compliance	Comment
		5.7.5.15 Lamps Extinguished Indication (LE) *That the mains supply to the signal lamps has been interrupted by:* *a) operation of the lamp switch, or;* *b) the lamp fuse being blown, or;* *c) the controller mains supply being off (only in the case of a separately powered OTU).* *This may include part time signal operation.* Our interpretation of this clause is as follows: - Where it refers to a "signal aspect fuse", it should read "signal aspects' supply fuse" or "lamp supply fuse". - Where a controller is configured for part-time operation, the Works Specification must specify whether LE should be active during part-time mode. In our implementation in order to provide maximum flexibility, the LE bit must be provided by Special Conditioning. However, typically an LE reply bit is not used and instead the interface uses G1/G2 being active as an indication that the signals are off.
4.5.24	Clarification	See our comment against clause 4.5.19 above.
4.5.25	Compliant	
4.5.26	Query	*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.* We would recommend that the wording in this clause just read: *Condition '1' confirms that the Red Lamp Monitor (if required by TR2500) has confirmed that at least one vehicle red signal aspect has failed.* It must not try to repeat the (possibly out of date) reasons why Red Lamp Monitoring would be fitted. In our implementation, Red Lamp Monitoring is provided as required by TR2500 and an RF1 Reply bits can be configured using Special Conditioning for maximum flexibility.
4.5.27	Query	*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.* We would recommend that the wording in this clause just read: *Condition '1' confirms that the Red Lamp Monitor (if required by TR2500) has confirmed that two or all vehicle red signal aspects have failed.* It must not try to repeat the (possibly out of date) reasons why Red Lamp Monitoring would be fitted. In our implementation, Red Lamp Monitoring is provided as required by TR2500 and an RF2 Reply bits can be configured using Special Conditioning for maximum flexibility.
4.5.28	Compliant	

TR2523	Compliance	Comment
4.5.29 4.5.30 4.5.31 4.5.32 4.5.33 4.5.34	Clarification	*4.5.29 Vehicle Count (VC) – A count of the number of vehicle pulses scaled by a predetermined scale factor.* *4.5.30 Queue Detector (VQ) – Condition '1' confirms that the Vehicle Queue Detector indicates a queue state.* *4.5.31 Car Park Occupancy Threshold Exceeded (CA) – Condition '1' confirms that the car park occupancy threshold is exceeded.* *4.5.32 Queue at Car Park Reservoir (CR) – Condition '1' confirms that a queue state exists at the car park entry reservoir.* *4.5.33 Car Park Closed (CL) – Condition '1' confirms that the car park is closed.* *4.5.34 Car Park Information (CSn) – Condition '1' indicates the state of specified signs associated with the car park.* Our interpretation of these clauses is that they define the name given to reply bits of this type, but that there is no requirement on the traffic controller to provide these bits. They are provided, if required, by the OTU directly or other external equipment, but not by the controller.
4.5.35	Compliant	
4.5.36	Clarification	*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.* Same comment as for 4.5.29 (etc) above.
4.5.37	Clarification	*Cabinet Door Open (CO)* *4.5.37 Condition '1' confirms that the cabinet door is open.* There is no specific requirement for a cabinet door switch in TR2500. If a door switch is fitted, then Special Conditioning can be used to generate this reply bit.
4.6.1	Compliant	
4.6.2	Clarification	*Option A, Master–Master Linking* In our implementation, if requested in the Works Specification, this method of working can be configured using Special Conditioning to allow the most flexibility.
4.6.3	Clarification	*Option B, Master–Slave Linking* In our implementation, if requested in the Works Specification, this method of working can be configured using Special Conditioning to allow the most flexibility.
4.6.4	Compliant	*Option C, Unlinked* This is the default operation.
4.6.5	Compliant	
		TR2523 Section 5 – Normative References
5.1	Noted	
5.2	Noted	
5.3	Noted	
5.4	Noted	
		TR2523 Section 6 – History
	Noted	
		TR2523 Appendix A – Cable Details
	Noted	
		End of TR2523

- End of Statement of Compliance -