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SYSTEM/PROJECT/PRODUCT: STC UTC SYSTEM

SYSTEM HANDBOOK

for an

STC UTC SYSTEM

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1. INTRODUCTION

1.1 Purpose

This document describes the Siemens (STC) Urban Traffic Control (UTC) System (including SCOOT) specified in the System Requirements Specification for an STC UTC System. See Reference 1.3.1(a). It is intended as an introduction to the UTC System facilities for day to day users of the System.

1.2 Scope

The scope of this document is limited to the standard STC UTC System plus a number of additional facilities available under licence (see section 2.3). In this context "standard" means that which is supplied by STC with no customer specific tailoring. That is, the facilities described are available at no extra cost unless specifically designated as licensed.

The document assumes that the reader has some basic Traffic Engineering knowledge, including knowledge about phases, stages, sub-areas, nodes, etc.

1.3 Related Documents

1.3.1 Parent Documents

- | | | |
|----------|------------------|---|
| 1.3.1(a) | 666/UH/16940/000 | System Requirements Specification for an STC UTC System |
|----------|------------------|---|

1.3.2 Kindred Documents

- | | | |
|----------|-------------------------------|---|
| 1.3.2(a) | 666/KE/16066/000 | UTC Glossary of terms |
| 1.3.2(b) | 666/UH/16940/xxx ¹ | Customer Requirements Specification |
| 1.3.2(c) | 666/HB/16940/000 | Operator handbook for an STC UTC System |
| 1.3.2(d) | 666/HD/16940/000 | Data preparation handbook for an STC UTC System |
| 1.3.2(e) | 666/HF/16940/000 | SCOOT User Guide |
| 1.3.2(f) | 666/HG/16940/000 | System Management Guide for an STC UTC System |
| 1.3.2(g) | 666/HH/16940/000 | Data Preparation Guide for an STC UTC System |
| 1.3.2(h) | 666/HI/16940/000 | Data File Format Guide for an STC UTC System |
| 1.3.2(i) | 666/HK/16940/000 | User Guide for the STC UTC System Roving Terminal |
| 1.3.2(j) | 666/HB/16101/003 | SCOOT Traffic Handbook V4.2 (supplied under licence) |
| 1.3.2(k) | TR 0141A | Microprocessor Based Traffic Signal Controller for Isolated, Linked and Urban Traffic Control Installations |
| 1.3.2(l) | 666/HP/16940/000 | Plan Preparation Handbook for an STC UTC System |
| 1.3.2(m) | 666/HT/16940/000 | Timetable Preparation Handbook for an STC UTC System |

¹ The 'xxx' in this reference replaces the 3-digit number that uniquely identifies a particular UTC System. That is, the customer variant for the Customer Requirements Specification.

- 1.3.2(n) TS004.003.2007 UTMC Objects Registry
(<http://www.utmc.uk.com/technical/04.html>)

1.4 Definitions

For all definitions and abbreviations used in this and related UTC documentation see the UTC Glossary of terms (reference 1.3.2(a)).

However, throughout this document the convention has been applied that 'System' means the UTC System and that 'system' applies to other things such as data transmission systems, computer operating systems etc.

Please note that throughout the document a number of ranges, or specific values, are mentioned. The following convention has been used in order to simplify the text. Immediately after each value, or range, a special character string indicates the requirement for modifying the value. These strings, and their interpretation, are as follows:

- (U) the value is user configurable
- (B) the value is modifiable only by STC during system build, if a value different from the value specified in this document is required. This value is recorded in the Customer Requirements Specification, Reference 1.3.1(a)
- (S) the value is configurable by STC
- (M) the value is not configurable.

1.5 Issue State and Amendments

- Issue 1.1A First draft for review
- Issue 1.1B Revised after issue of System Requirement Specification
- Issue 1.1C Revision after engineering comments
- Issue 01.00D Revision after second set of comments prior to review
- Issue 01.00 Revised after engineering review
- Issue 02 to 06 Not Issued
- Issue 07.00 DC 9338, 10-SEP-93. Minor amendments and issue state now reflects Software issue state
- Issue 08.00 New facilities added and amendments
- Issue 09.00 Revised following update of SRS (DC12554 refers)
- Issue 10.00 Revised and updated to reflect V10 software
- Issue 11.00 Not issued
- Issue 12.00 Revised and updated to reflect V12 software
- Issue 13.00 and 14.00 Not issued
- Issue 15.00 Revised and updated to reflect Version 15 software

Issue 16	Not issued
Issue 17	Revised and updated to reflect Version 17 software
Issues 18 to 20	Not issued
Issue 21	Revised and updated to reflect Version 21 software
Issues 22	Not issued
Issue 23	Revised and updated to reflect Version 23 software. Added description of Primed green wave.
Issues 24 to 27	Not issued
Issue 28	Revised and updated to reflect Version 28 software
Issue 29	Not issued
Issue 30	Add appendix for external copyright declarations, and update appendices.
Issue 31	Remove references to VAX, Alpha and make hardware neutral

2. GENERAL

2.1 System Overview

UTC Systems were originally designed to provide a central control and monitoring point for junction and pedestrian controllers. The System provided a means of easily varying the stage timings without having to make wiring changes to each controller. As a consequence traffic authorities obtained a facility which allowed them to respond to special events. The monitoring facilities of the System meant that maintenance effort could be directed at more immediate problems, whilst also providing more information about the problem. Over the years the System has developed to include a wide variety of facilities, such as car park control, diversions, green waves and SCOOT.

Physically the System comprises two main parts connected by either 2 and/or 4 wire circuits that are normally supplied by the local telephone company. The two parts are:

- (a) Instation equipment (the computer equipment, UTC System software, terminals and instation data transmission equipment), located in the control centre.
- (b) Outstation equipment comprising Outstation Transmission Units (OTUs) connected to signal controllers, traffic detectors, etc. on the street.

The terminals used to control the System normally comprise a mixture of hard-copy terminals, monochrome VDUs, PC and GUI² workstations, which may be located at the Control Centre or remotely as required. A 'roving' terminal to assist in SCOOT validation may also be supplied. This allows an engineer on the street to communicate with the System by a radio link.

The STC data transmission system comprises the instation equipment in (a) and OTUs in (b) above and is used for communication between the computer(s) and the on-street equipment.

2.2 System Facilities

The sections that follow describe the facilities of the standard STC UTC System. Where possible, main sections of this document have the same title as sections of the Systems Requirement Specification (reference 1.3.1(a)). Thus section 3 in this document relates to section 3 in the Systems Requirement Specification, both sections having the title "Equipment Identification". Where applicable this relationship is also maintained between sub-sections of this document and sub-sections of the Systems Requirement Specification.

2.3 Configurable Facilities

The following facilities are configurable items and may be subject to additional charges. For more details contact STC.

² Graphical User Interface. These terminals use a Windows, mouse and icon-based interface.

- 2.3.1 UTC Facilities
 - Windows-based Graphical User Interface (GUI).....see section 9.4
 - Multiple demand dependent stagessee section 7.1.2(1)
 - Gap Outsee section 7.1.2(10)
 - Extended logging.....see section 4.14
 - LF3 lamp fault support.....see section 7.1.3(14)
 - Upload / download of controller data.....see section 16.11
 - Foreign language support.....see section 16.7
 - Detector Histogram Displayssee section 9.4.4(4)
 - Message Sign Controlsee section 8.8

- 2.3.2 SCOOT Facilities
 - SCOOT.....see section 7.11
 - Storage of event driven messages to disc.....see section 9.8
 - Multiple removable SCOOT stagessee reference 1.3.2(e)
 - Changing SCOOT maximum and minimum stage lengths ..see reference 1.3.2(e)
 - Link travel time collectionsee reference 1.3.2(e)

- 2.3.3 Links to External Facilities
 - RMS (Remote Monitoring System)see section 16.4
 - NMCS (Motorway Control System)see section 16.5
 - ITMC Interface.....see section 16.8
 - ASTRID.....see section 16.9
 - Analogue Sensor interfacesee section 16.6

3. EQUIPMENT IDENTIFICATION

3.1 Identifying single items of equipment

3.1.1 UTC Equipment

Each item of equipment within the UTC System has a System Code Number (SCN) associated with it. This is made up of a letter indicating the type of equipment and a 5-digit code.

The equipment type letters are as follows:

- A - All equipment
- C - Car park
- D - Counting detector
- E - TC12 PC
- F - Special facility / Plan associated sign
- G - Green Wave Route
- H - Computer hardware
- J - Junction controller
- K - NMCS II equipment
- L - Tidal/Tunnel Flow controller
- M - Message Sign
- N - SCOOT Node, Link, Stage or Detector
- P - Pelican controller
- Q - Queue detector
- R - SCOOT region
- S - Car park sign
- T - Terminal (VDU / PC Workstation / Printer)
- U - Diversion
- V - Diversion Sign
- W - Analogue Sensor
- X - Outstation Transmission Unit (OTU)
- Y - Outstation Monitoring Unit (OMU)
- Z - Remote Request.

The 5 digits of the SCN are of the form:

SSGOE

where the letters signify:

- SS the sub-³area associated with the piece of equipment.
- G which group in the sub-area is associated with the equipment. In this context "group" can be viewed as a "sub-sub-area"
- O which OTU in the group is associated with the piece of equipment
- E this digit allows equipment of the same type to be connected to one OTU. Normally this has the value 1; however for OTUs with more than one junction, count detector etc., each piece of equipment is given a different value.

For example:

J12345 refers to junction number 5 of OTU 4 in group 3 of sub-area 12.

Particularly during Data Preparation the last three digits are known collectively as GOE, for Group, OTU and Equipment. These digits are used to allow wildcarding⁴, see section 3.2 for more information. For all items of outstation equipment the "GOE" digits must be non-zero apart from the "E" digit for OTUs, which is always zero.

For instation equipment the first two digits of the SCN define the computer (01-08, 99). In particular the digits 01 identify the computer as TCCA, see section 11.2, 02 as computer TCCB and 99 as the TMC. For the computer itself the "GOE" digits are always zero, for terminals they indicate the terminal number.

For example:

H01000 refers to computer number 1, TCCA. This may also be the TMC, see section 11.1.

H99000 refers to the TMC.

T02001 refers to the first terminal port on computer number 02, TCCB.

In the exceptional circumstances where 6 digit SCNs are used the sub-area has 3 disits rather than 2.

3.1.2 SCOOT Equipment Identification

The SCN, used to identify elements recognised by the SCOOT sub-System, consists of a prefix letter followed by a reference name. The components of the SCOOT SCN are described in reference 1.3.2(e).

For regions⁵ the prefix letter is "R" and the reference name two letters, for example:

RLA Region LA

³ It should be noted that all the equipment for one sub-area must be contained within one Traffic Control Computer (TCC).

⁴ For both green waves and diversions the 5 digits have no specific meaning and hence cannot be wildcarded for use during control.

⁵ Note that SCOOT regions must be completely contained within a TCC.

For all other elements the prefix letter is "N", for node. The reference name then consists of 5 digits⁶ followed by a suffix indicating the type and identity of the equipment. For example:

N30111	Node 30111
N30111D	Link D on node 30111
N30111D2	Detector 2 on link D on node 30111
N30111/3	SCOOT Stage 3 on node 30111

From this it can be seen that a node SCN followed by a single letter indicates a link, a link SCN followed by a single digit indicates a detector and a node SCN followed by a "/" and a single digit a SCOOT stage.

3.2 Referring to sets of equipment

3.2.1 UTC Equipment

In order to allow more than one item of equipment to be accessed by a single SCN, the System has a convention for wildcarding SCNs. This is achieved by using "0"s in the sub-area, "G", "O" or "E" positions. So that if the "GOE" digits of an SCN were zero, the SCN would refer to all equipment in the specified sub-area.

For example:

J62390	refers to all junctions on OTU 9 in group 3 of sub-area 62
J21300	refers to all junctions on all OTUs in group 3 of sub-area 21
J12000	refers to all junctions in sub-area 12
P00000	refers to all pedestrian controllers in the System

The convention does not allow wildcard zeros to be followed by a non-zero digit, that is J12001 is invalid.

The exceptions to this convention are control centre equipment, green waves and diversions that do not allow embedded zeros as the "GOE" digits have no significance.

Wildcarding for computers and terminals is achieved by setting all 5 digits to zero.

Green wave and diversion SCNs cannot be 'wild-carded', except in request for information commands, as the 5 digits have no significance.

3.2.2 SCOOT Equipment

Wildcarding of SCOOT elements is achieved using '*'s in a straightforward manner. Some examples of these are as follows:

R*	All regions
----	-------------

⁶ It is a sensible convention that the 5 letters for the SCOOT node are the same as the 5 digits for the junction or pelican controller.

N*	All nodes
RLAN*	All nodes in region LA
N**	All links on all nodes
N30111*	All links on node 30111
N***	All detectors on all links on all nodes
RLAN***	All detectors in region LA
N*/*	All stages on all nodes
N30111/*	All stages on node 30111

4. SYSTEM CONTROL AND CONFIGURATION

4.1 UTC System Start Up

Normally the System starts automatically after a power failure. However, if necessary, the computer(s) has (have) a restart button on the front panel which when pressed and released automatically starts the System. More details can be found in the System Management Guide (reference 1.3.2(f)).

On start-up the computer(s) require to know the time and date. Operator intervention is only required if this is the first, or only, computer to start and its battery backed clock has failed. In this case the System prompts the operator for the time and date.

In a multi-computer System when a TCC restarts its data is compared to the data in the TMC. If it is different then a new set of data is downloaded from the TMC. When the TMC restarts it compares the TCC(s) data with its own and if different a warning⁷ is issued.

4.2 UTC System Time

The UTC System computer is provided with a clock unit to store the time and date and, by use of its battery, maintains this data through periods when the computer is powered off. The unit is used at System start-up as the source of the current time and date - see section 4.1.

During normal System operation, the time and date is maintained within the software. At System start up this is synchronised to the time and date obtained from the system clock. Thereafter the software time and date is not synchronised to the system clock although it is compared with it every minute and any significant discrepancy reported as a fault. All time-dependent functions within the System use the time and date stored in the software as a reference.

If the System is configured to accept the synchronisation date from an external source (see section 16.12) and such data is available at start up, then the external source time and date are used to set the System's date and time.

The System also provides a facility for automatically moving the clock forward and backward once per year for daylight saving, known as Daylight Saving Time (DST). The dates are user configurable and are described in the Data Preparation Handbook (reference 1.3.2(d)).

In a multi-computer System the TCC(s) take their initial time from the TMC. If this is not available then the TCC takes its time from the TCC with the lowest SCN.

4.3 UTC System Capacity

The amount of equipment that a single UTC computer can control or monitor is given in Appendix D and the Customer Requirement Specification (reference 1.3.2(b)).

⁷ The TCCs are not automatically updated to avoid the TCCs being restarted in the middle of a peak period when the TMC is restarted.

4.4 Timetables

4.4.1 Introduction

The Timetable facility makes it possible for the operator to schedule events to occur automatically at some time in the future. The events are implementations of commands that can be set up to occur without the operator's presence. However, fixed time plans selected by timetable do not have the same force as a command entered by an operator, see section 7.4. The times at which the events are to take place are set up and stored in the System timetables as part of System data preparation - see section 6.

Two types of timetables are available on the System:

date-of-year

day-of-week

These are described below. Further descriptions of the content of each type of timetable can be seen in reference 1.3.2(h).

4.4.2 Date-of-year Timetable

Only one date-of-year timetable is allowed and it is used to define dates in the year when a particular time-of-day timetable is to be used. The date-of-year timetable takes precedence over the day-of-week timetable.

4.4.3 Day-of-week Timetable

Again, only one day-of-week timetable is allowed and it is used to define which of the time-of-day timetables are to be used on a particular day of the week.

Within the UTC System, the date-of-year and day-of-week timetables are combined into a single timetable.

If at System start up there are no entries in the day-of-week or date-of-year timetables for the current day, the System leaves all equipment under local control and only implements operator commands.

4.4.4 Time-of-day Timetables

The System provides a number of timetables that may be either used on a day-of-week or date-of-year basis.

The time of day timetable defines the time at which particular events are to occur during a 24-hour period. The action times for the events can be specified to the nearest second. The event is performed on or as soon after the action time as processing allows. The events are defined in a similar way to operator commands, although the parameters may not be identical. See the Operator Handbook (reference 1.3.2(c)) and the Timetable Preparation Handbook (reference 1.3.2(m)) for more information. The commands that are available for action by the timetable are defined in **Error! Reference source not found.** The System allows a number of such "time-of-day" timetables to be set up. Usually a System contains one timetable for the weekdays, one for the weekend and others for special occasions such as public holidays, carnivals, sports events, etc.

The time-of-day timetable entries may be preceded by a day-of-week, to indicate that command will only be actioned on the particular day of the week, or by a date, to indicate that that command will only be actioned on that date (a "single shot" event).

4.4.5 Timetable substitution

An operator command permits the substitution of the current timetable with another valid timetable. The substituted timetable continues in operation until midnight or until superseded by another substituted timetable.

Selecting a new timetable causes an entry to be made in the System Log.

4.4.6 Timetable summary

The use of an additional, option, parameter may be used to produce a summary of all the timetabled commands which affect a single junction or pelican controller during the course of a week.

4.5 CASTs (Commands Actioned and Stored Together)

4.5.1 Introduction

The CAST facility allows the user to configure a set of commands so that they can all be invoked by a single timetable entry or operator command. Typically CASTs are used to change SCOOT default stage lengths and translation plans, or to modify the System for a special occasion.

The operator can add and remove commands in a CAST or obtain a list of the commands in a CAST. CASTs can be referred to either by their number or user definable name. Commands removed from a CAST are (S) listed in the System Log.

The operator can associate 3 CASTs with a Remote Request. The first CAST is actioned when the Remote Request is asserted, the second CAST when the Remote Request clears and the third CAST a user-definable time after clearance of the Remote Request.

The operator can associate a CAST with a SCOOT region, such that when the cycle time of that region passes through a particular cycle time, either rising or falling, a CAST is actioned. Alternatively, this facility can be set to run in a "test" mode whereby a message is output rather than the CAST being actioned.

4.5.2 Multi-computer Operation

In this type of System the TMC must be available for CASTs to be changed. Once a change has been made the TCC(s) are updated with the revised data. The TCC computers are also updated from the TMC when they restart.

4.5.3 Available Commands

The commands available within a CAST are restricted to those shown in **Error! Reference source not found.** The commands within each CAST are actioned in

sequence immediately following the timetable or operator request to action the CAST.

4.6 Command Journal

4.6.1 Introduction

The Command Journal is created by storing selected commands from the operator and the timetable. It forms a record of the current control state and is used when the System restarts, to re-impose the previous command state. As the journal cannot be infinite in size it is compressed daily and on System start-up by the journal optimiser.

On System restart the journal is optimised and the commands in the journal executed. If the time of the last command in the journal is for a different day the timetable for that day is run from the last time in the journal until midnight of that day, and then the timetable for the current day is run from midnight until the current time. If the last time in the journal is in the current day then the timetable is run from the last time in the journal until the current time.

4.6.2 The Journal Optimisation Process

Only commands entered before the optimisation system started are processed. The commands are scanned and any that result in no change to the System state are removed. Any commands added after the process started are then appended to the new journal before the process stops.

4.6.3 Multi-computer Operation

Each computer, whether TCC or TMC, holds its own local journal file.

4.6.4 Facilities Available

It is possible to list the journal on an operator's terminal. The optimised commands are listed first, followed by the commands entered after optimisation.

The journal is cleared when the System data is updated or when requested by operator command.

A list of commands that are journalled is given in **Error! Reference source not found.**

4.7 Fault Detection and Notification

4.7.1 Introduction

The System provides facilities for detecting faults in both its own operation and that of the on-street equipment to which it is connected. These facilities provide a defined response to the detection of each fault type. The fault types covered by this facility include:

Software Integrity	section 4.9
Terminal	section 4.10

Data Transmission	section 4.12
Plan Compliance	section 7.13
SCOOT Detector	section 8.8
Other on-street equipment	section 8.9

4.8 Fault Category Groups

The System allows the fault categories given in 16.21Appendix C - to be gathered together in groups. The fault categories contained within a group may be specified in either an inclusive or exclusive way. Fault category groups are identified by four digit numbers. Fault category group numbers may be used in fault llisting commands.

4.8.1 Fault Recognition

The System looks for the faults described in the following sections by checking the equipment's status of the following:

- (1) Reply data provided by the data transmission system is analysed for its own faults plus plan compliance, controller and SCOOT detector faults
- (2) Status data associated with computer terminals and disc drives is analysed
- (3) A status word set up by the System's own software is monitored to show its correct operation.

4.8.2 System Response to Faults

The detection of each new fault of all types gives rise to the following actions:

- (1) The fault is recorded in the current fault log. This contains the faults that are currently outstanding for each piece of equipment and may be easily examined by an operator;
- (2) If a suitable alarm or indication panel is included in the System, the audible and visual alarms are activated. For terminals with status lines, see section 5.1.6, these are also updated;
- (3) A fault message is output on terminals that are configured to receive fault reports and also written to the System Log, section 4.13;
- (4) If the fault applies to on-street equipment then depending on the fault category it may be isolated;
- (5) If a fault on one item of on-street equipment causes isolation of or otherwise affects other on-street equipment in the same TCC then these items are also isolated and this action reported (known as a Link List).

The monitoring of faults is arranged in a hierarchical order such that the detection of a fault does not cause other, consequent, fault conditions to be reported.

Once a fault has been detected and logged the same fault is not reported again on the equipment unless cleared in the meantime.

4.9 Software Integrity Faults

A Software Integrity fault occurs if those parts of the software that are run every second do not complete their execution by the end of the second or an arithmetic check test fails. If a software integrity fault occurs on each of three consecutive seconds the on-street equipment is disconnected from the system.

The fault is recorded in the System and Fault logs.

4.10 Terminal Faults

Certain types of terminal, when connected to the System, can be monitored for correct operation. This is achieved by regularly asking the terminal to report its identity. If the terminal does not respond then a fault is reported in the usual way. Typically such a fault occurs because a printer has run out of paper, is switched off or a terminal has the scroll lock feature on. Output to a faulty terminal is discarded by the System, except for the System printer. See the description of the System log, section 4.13, for more details.

If a terminal is of a type that cannot be monitored for correct operation, the System will assume that the terminal is always on-line and will always attempt to send data to it.

4.11 Operator Fault Clearance

The System allows faults to be cleared by the use of an operator command. The use of this command causes the appropriate entry in the fault log to be cleared, a message to be sent to the System Log and on-street equipment returned to the currently requested mode of operation. Only when a fault has been cleared can it be detected again.

The Remote Re-connect facility, section 7.1.3(16), can be used by maintenance personnel to clear faults affecting junction or pedestrian controllers. In this case all items of equipment isolated as a result of the fault are reconnected.

4.12 Data Transmission Faults

Data Transmission Faults are designed to indicate that an error has been detected in the transfer of data between the TCC and the on-street equipment. Checks are made for the following three types of error:

- (a) No reply
- (b) Intermittent
- (c) Persistent

In order to simplify the wording of this section specific numeric values have been used; where these are configurable during data preparation a "(U)" has been added.

If no reply is detected from an OTU for 3 (U) consecutive seconds a No reply fault is reported and all on-street equipment connected to the relevant OTU isolated. The fault is automatically cleared and the equipment on the OTU reconnected if the fault clears and does not recur for 30 (U) seconds.

If the count of transmission errors exceeds 15 (U) in one hour an Intermittent transmission fault is reported but equipment connected to the OTU is not isolated. The fault will be automatically cleared if no more than 15 (U) transmission errors have occurred in the hour since the last time that the one-hour intermittent fault threshold was exceeded.

If more than 15 (U) errors occur within a 180 (U) second period, a Persistent transmission fault will be raised and on-street equipment connected to that OTU isolated. If no transmission errors occur within a continuous 180 (U) second period the persistent transmission fault will be automatically cleared and the on-street equipment reconnected.

When either of the faults or clearances above occur, the fault log is updated and a message sent to the System Log.

4.13 System Log

The System Log is a magnetic and paper record of activity on the System. It records fault occurrences and clearances, control mode changes, operator commands that affect on-street control and comment lines entered by the operator.

The paper log is output on the System Log Printer. If this goes faulty then a record is kept of where in the log printing failed. When the printer is back on-line the printing starts where it left off. Printing of the System Log may be disabled by an operator command.

System messages are transferred from the TCCs to the main log on the TMC's System disc. If the TMC is unavailable then data is held in the TCCs and sent to the TMC when it comes back on-line. On a daily basis the day's log information is "archived" to a separate file, the lifetime of this file being user configurable. Data is archived from the System Log when the log is full and a warning message is also given.

The contents of the System Log can be listed on any suitable terminal by operator command. This command allows the data to be selected by SCN, fault category, date and time period. The System Log can be down-loaded to a suitable PC terminal - see section 10.2.

4.14 Extended Logging

Note: licensed facility - see section 2.3.

An optional facility is available that allows approximately six years' of log entries to be stored and to be immediately accessible by an operator. This facility requires an additional hard disc to be installed in the System's TMC.

4.15 System Re-Starts

The UTC System provides an optional facility which allows the SCOOT settings of cycle time, stage lengths and offsets, which were in effect prior to a System shut down to be re-instated after the System has re-started. The re-instatement of SCOOT settings only occurs if the period between System shut down and re-start is short (less than 5 minutes).

5. OPERATOR FACILITIES

The operator facilities allow the operator to control the on-street equipment and provide the operator with fault, advice and event messages. In order to use the System an operator does not need to know which computer (TCC) actually controls the equipment.

Control of the System is achieved using commands that allow the operator to start or stop a function, prepare new or changed data or implement new forms of on-street control.

System monitoring is achieved by a system of messages routed to appropriately configured terminals and to the System Log. The basic message types are as follows:

- Fault messages (UTC and SCOOT)

These occur when the System detects a fault. See Appendix C - for a list of the fault categories. For some SCOOT faults the messages have to be enabled.

- Advice messages (UTC and SCOOT)

These occur when the mode of control at a junction or pedestrian controller is changed, when a car park changes state, when a diversion starts, etc.

- Event messages (SCOOT)

These have to be requested and they occur at the appropriate moment in SCOOT's operation.

5.1 Operator Command Entry

5.1.1 Introduction

The following two types of command are provided:

- Traffic commands provide traffic control facilities and are entered into the System using simple mnemonics, for example PLAN J21000 12 - start plan 12 for all junctions in sub area 21;
- Maintenance commands allow access to the VMS operating system command language, DCL.

Each command is entered into the System by first typing a single prompt character, the character determining the type of command that the System expects to follow:

Prompt

Character

Level

- | | |
|----|----------------------------|
| - | Expert Traffic command; |
| # | Novice Traffic command; |
| \$ | Maintenance command (DCL). |

5.1.2 Expert Command Entry

The normal command entry system allows the operator to input commands in a direct way. The command and its parameters are entered all on one line separated by spaces.

5.1.3 Novice Command Entry

The Novice Command Entry facility allows the operator to input commands in an interactive way. The System defines what parameter should be entered next and checks the syntax and range of the parameters. The validity of the input is not checked until ALL parameters have been input. It also gives 'help' information on the command if required.

A command is entered in novice mode by entering the novice command prompt '#' instead of the expert UTC command prompt. The operator now enters as much of the command that he remembers, the System then prompts for each missing parameter until the command is complete. At any point the System may:

- (a) output a message defining and prompting for the next parameter, if all input parameters are syntactically correct;
- (b) output an error message together with a description of the parameter format required for the invalid parameter, if a syntactically incorrect parameter is entered. The command is then re-input, although the use of command line editing, section 5.2, can be used to minimise the amount of retyping required.

If the command entered is not implemented on your System or is invalid, a message indicating this is output, supplemented by a list of available commands in the latter case.

If help is required for the command itself, a '?' can be entered following the prompt for a parameter. This causes the help display for this command to be displayed on the terminal.

Entering all the necessary parameters at once causes the command to respond as though it had been entered in 'normal' mode.

5.1.4 On-line Command Help

The System provides a help facility. For example:

```
HELP PLAN
```

5.1.5 Available Commands

Command Functions - a full list of UTC and SCOOT commands is given in **Error! Reference source not found.** Details of command line formats and parameter ranges are given in the Operator Handbook (reference 1.3.2(c)).

5.1.6 Terminal Characteristics

System access facilities can be restricted on a per-user or per-terminal basis. This is done during preparation of the System data; see section 6. It allows a terminal to be capable of handling each of the following:

- (a) UTC commands
- (b) SCOOT commands
- (c) UTC output
- (d) SCOOT output
- (e) Use of the facility to over-write the data being sent to and received from an OTU
- (f) The UTC sub-areas for which the terminal accepts commands
- (g) The type of terminal, e.g. PC workstation or VDU
- (h) Operating systems commands, i.e. maintenance mode
- (i) Command level available
- (j) Urgent messages only
- (k) Define where printing requested by this terminal should be output
- (l) A status line, or equivalent, indicating the current status of the System and Operational alarms, to which computer the terminal is attached and the current status of the inter-computer links.

5.2 Command Line Editing

The System stores a number of previously entered command lines. The re-use of previous commands enables the operator to react quicker to give faster System control and avoid repetition of often used commands. The operator can also quickly edit a previous command if minor changes are required. Only the most recent command lines are stored.

The operator can view the previous commands using the "up" and "down" cursor keys. The command displayed can then be edited using the "left" and "right" cursor keys, the delete key and characters inserted as appropriate.

5.3 Access Control By Password

The System provides a means of controlling access using a user identity and password system. These are set up during data preparation.

Passwords stored within the UTC System are encrypted.

Terminals that are connected to the System directly by a serial interface can be configured not to require a password to gain access to the System. However, terminals connected through terminal servers (see section 13) must use password access control.

Details of users connecting to, and disconnecting from, the System are recorded in the System Log and on terminals configured to report UTC messages.

It is also possible to obtain a list of the identities of all users who are currently connected to the System using an operator command.

5.4 Dial-Up Access

This facility allows a terminal to be connected to the System through the normal telephone system using modems. The terminal is treated as a normal operator terminal by the System all the time it is connected.

Access is controlled by the user identity/password system, see section 5.3. Individual users or the whole System can be enabled or disabled by use of commands on another terminal or by timetable action.

An additional protective measure (optional, though essential when the terminal is configured as having access to maintenance commands) is the dial-back⁸ facility whereby after validating the User Identity and Password the System clears the call and dials the terminal back using a subscriber line number specified with the User Identity.

For dial-up access the modem at the System Instation connects to a RS232C port.

The Roving Terminal is a special form of this facility, described in SECTION 14.2.11.

5.5 Wall Map

The traditional wall map is a surface containing a visual representation of the control area. It normally has small lamps (LEDs) that are used to indicate various conditions. Typical uses of such lamps are:

- (a) Up to 3 lamps can be used for junction and pedestrian controllers, indicating an OTU fault, a controller fault or operator imposed plan;
- (b) Queue detectors have 1 lamp indicating the presence of a queue;
- (c) Diversions have 1 lamp indicating that it is active;
- (d) Green Waves have 1 lamp indicating that it is active;
- (e) Special Facilities have either 1 or 3 (B) outputs.

Information about how the lamps can be controlled is contained in the System Requirement Specification (reference 1.3.1(a)) and Customer Requirement Specification (reference 1.3.2(b)).

For Systems with one output, the output is -

- (a) Off as default;
- (b) On when the special facility is active;
- (c) Flashing when there is a fault.

For Systems with three outputs -

1. The first output is:
 - a) Off when no OTU fault is present;
 - b) Flashing when an unacknowledged OTU fault is present;

⁸ This facility does not currently work using the roving terminal, as the cellular telephone network does not respond to the control sequence as the System expects.

- c) On when an acknowledged OTU fault is present.
- 2. The second output is on when the facility is active;
- 3. The third output is on when the facility is activated by operator command.

5.6 System Indication Panel (SIP)

A SIP is used to bring to the operator's attention an event that may require intervention. This is done using both visual and audible indications. The SIP normally indicates two alarm conditions, a system alarm associated with faulty equipment and an operational alarm. It is possible to have more than one SIP, the actual number depending upon individual customer requirements. These are detailed in the Customer Requirement Specification (reference 1.3.1(a)).

6. DATA ENTRY

6.1 Data Preparation

6.1.1 Introduction

The Data Preparation facility allows data to be entered into the System and made ready for use whilst the System is running. Changes are not implemented, however, until preparation is successfully completed and the user requests the new data to be installed. Plan preparation is a separate process, which is described in section 6.2, and more fully in Reference 1.3.2(l). Timetable preparation is also separate and is described in section 6.3 below, and more fully in Reference 1.3.2(m).

Details of the number of stages, timings etc. of the street equipment making up the System are supplied by the customer. SCOOT detector information is determined during the SCOOT loop siting survey.

6.1.2 The Process

The System provides an operator command that starts the data preparation process. Only one user can access the data at one time. The operator selects which part of the System data is to be prepared and can call on 'help' facilities at each stage of selection.

When the updated System data has been produced, an operator command to install the new System data may be issued. If only new timetables are to be installed the System remains on-line, otherwise it goes off-line temporarily whilst installation is carried out and the System restarts.

6.1.3 UTC and SCOOT data

Data for UTC and SCOOT is entered using a forms based package (FMS). This is a menu driven software package that requests the data required on template VDU screens with individual fields for particular data items. The data is validated for type (alphabetic, numeric, etc.), for range, (0-4, A-H, etc.), and for compatibility with other data in the System that has already been entered. Each field to be filled is preceded by text describing the data item required and a help facility is available.

Data for street equipment and for the SCOOT model is entered separately and then checked for compatibility. All inputs are, where possible, validated. No invalid data is accepted. The data is written to the System data area only when no errors are detected.

Facilities are provided for "backing up" the data to an off-line storage medium, e.g. magnetic tape, or the System may be configured (S) to store the data on the System's hard disk(s).

6.1.4 Terminal and User Data

Terminal and User configuration data are both entered through an interactive process. See reference 1.3.2(d). This process can only be performed by one user at a time.

6.1.5 Messages

UTC and Event Driven Messages are set up by STC. Minor textual changes to existing messages may be made using the screen editor under the control of the Data Entry system. See reference 1.3.2(d).

6.1.6 Foreign Language Messages and Dictionaries

Note: licensed facility - see section 2.3.

The System may be configured to operate with a foreign language interface. The UTC and event messages and dictionary are entered using the same process as section 6.1.5.

6.2 Plan Data

The System provides an operator command for starting the plan preparation process. Plan preparation can be performed by more than one user at a time. However, data preparation and plan preparation cannot be used simultaneously. When new intersection or pelican equipment is added or data modified via the Data Preparation process the plan preparation process should be called from the data preparation menu to correct the out-of-date plans.

Plan data is entered using a screen based software package that permits the modification of all equipment on a single plan or all plans for a single equipment, for fixed-time, SCOOT, green waves and modified plans. Historical plans can be displayed and used as the basis for editing, and faulty plans are displayed. Any plan with faults for a number of equipment can be processed, the plan then being implemented for all equipment apart from those with faults.

See reference 1.3.2(l) for full details of the Plan Preparation facility.

6.3 Timetable Data

The System provides an operator command for starting the timetable preparation process.

There are two versions of the timetable preparation program; windows based and non-windows based. The Windows version supports more than one user carrying out timetable preparation at a time. The non-Windows version may only be used by one user at a time. Data preparation and timetable preparation cannot be used simultaneously.

See Reference 1.3.2(m) for full details of the Timetable Preparation process.

6.4 Baseline Data

Some data, such as the SCOOT model information or car park values are not easily determined prior to System installation, but are needed for the System to

work effectively. These items of data are entered through the baseline system, using the RUBA command, and a complete list is contained in Appendix B - .

New data may be added to the baselined data only when the TMC is on-line. The data is stored on the TMC and the TCCs are updated accordingly. When a TCC is restarted the baseline data is loaded from the TMC. If the TMC is unavailable then the TCC starts with its current data.

When a new SCOOT node is brought on-line the Saturation Occupancy, Journey Times, etc. contain default, normally large, values. When the actual values have been determined the new values may be entered by the operator into the System using the CHAN command and are used immediately. Once the values have been verified as correct then the data may be entered into the permanent data set using the RUBA command without recourse to the Data Entry process; when the System is next restarted these values are automatically used as the new default values.

If the SCOOT Link Validation Screen, section 9.2.6, is used to enter new data then on exiting the screen the modified values are automatically baselined.

7. JUNCTION AND PELICAN CONTROL AND MONITORING

7.1 Junction Interface

7.1.1 Introduction

This section describes how the System communicates with the junction controller. "F" bits are used by the System to tell the junction controller what stage is required and the "G" bits are used by the junction controller to inform the System what is the current stage. The "F" bits are sent automatically by the System according to the pattern and timing of stage requests in a fixed time plan or at the request of the SCOOT algorithm.

Every junction controller has to have at least two Stage Control and Reply Bits. In addition to these, up to 14 control/reply bits for Telecommand 8 OTUs and 16 for Telecommand 12 OTUs are then configured in a number of formats and each junction controller is then associated with a format. Thus each junction has both Stage Control/Reply bits and Data bits. If required, and spare bits are available, more than one junction controller may be connected to an OTU.

7.1.2 Junction Control Bits

(1) Stage Control Bits - Fn

Each stage on a junction has an "F" control bit associated with it, which is used to tell the controller which stage to go to. A minimum of two and a maximum of eight stages can be configured on a controller. When a junction controller sees the "F" bit for a normal stage the System expects the controller to move to that stage. Failure to do so results in a fault being reported. If the "F" bit stage is demand dependent the junction has the opportunity to respond to on-street demand. This opportunity is terminated when a second "F" bit is sent for a normal stage. If there is no on-street demand the junction is expected to move to the normal stage. The System copes with up to two (or eight - see section 2.3) demand dependent stages per junction controller.

The fault detection process is inhibited for a period after a plan change involving the junction in order to allow the junction time to catch up with the plan.

(2) Common Demand Bit - DX

The "DX" control bit is intended to simulate a demand for every demand dependent phase, stage or extension for a junction and causes them to run when their "F" bit is sent. It can be used to force a stage when the local VA detector is faulty and is used for controller checks, section 7.14. It can also be used to ensure that junctions respond precisely as required during green waves (see section 7.6) and for traffic engineering reasons. The "DX" bit can form part of a plan or it can be set by operator command.

(3) Stage Demand Bit - Dn

A "Dn" control bit is intended to simulate a demand for a specific demand dependent stage. It can be used to force a specific stage when the detector is

faulty, to force a stage during a green wave or for traffic engineering reasons. The System allows a maximum of two (or eight) demand dependent stages per controller and the "n" is used to indicate the stage letter. The "Dn" bits can form part of a plan or can be set by operator command.

(4) Part time signals - SL

The "SL" control bit is used to switch part time signals on or off and the "OL" reply bit to confirm that this has happened. The facility is available through the timetable or by operator command.

The System allows the sense of the "SL" bit to be configured for each junction such that one junction may use SL set to 1 to switch the signals and another use 0.

(5) Solar Switch Override - SO

The "SO" control bit is used to switch all the signal aspects at a junction from the dim state (normal during the day) to the bright state. This is normally used during bright sunlight to make them more visible. The facility is available through timetable, CAST or operator command.

(6) Local Link inhibiting - LL

The "LL" control bit is used to modify the operation of a junction that is not currently controlled. Normally it forces the junction controller from its normal off-line mode to the vehicle-actuated mode. It is available by timetable or operator command.

(7) Synchronise Controller time - TS

The "TS" control bit allows the System to synchronise the real time clocks of all suitably equipped MCE 0141 controllers, thus ensuring that co-ordination is maintained when the System is off-line. At a pre-defined time the bit is cycled through a "101" sequence by the System, and those controllers with this facility set their internal clocks to the pre-defined time on the leading edge of the second "1". This action is confirmed with the "CS" reply bit. The pre-defined times are configured for each junction individually.

An additional facility can be configured for each controller such that the number of seconds' reply of the TS bit determines the day-of-week in the controller's internal clock.

(8) Fallback Mode - FM

This facility causes the "FM" control bit to be sent that allows the CLF mode of a controller to be disabled such that it works in VA mode when no control bits are being sent. It can be set by timetable or operator command. The controller may be configured so that the "FM" bit selects any of the fallback modes.

(9) Synchronise Group Timers - SG

This facility allows the synchronisation of group timers of the type fitted to STC Type 90 controllers or those of other manufacturers conforming to the same specification⁹. It switches the "SG" control bit in a similar manner to the Synchronise Controller Time Facility. However, the System uses configured information to determine when the "101" sequence should be sent to ensure synchronised control over the System.

In order to use this facility the following items of data are required:

- (i) The time at which synchronisation occurs for all junctions in the System.
- (ii) The cycle time for each suitably configured junction controller
- (iii) The required offset from an arbitrary start point for each suitably configured junction controller.

Starting at the junction with the lowest IRN¹⁰ the System synchronises one controller at a time. For each controller it determines when the next occurrence of the required offset is due. It then toggles the SG bit in a "101" sequence so that the leading edge of the second "1" occurs on the required time.

The "SR" reply bit confirms that controller has synchronised to the "SG" bit and if configured is looked for after the "SG" "101" sequence. The "GR1" bit is returned for the whole of group 1.

(10) Gap Out - GO

Note: licensed facility - see section 2.3.

When the "GO" control bit is sent to a controller together with multiple stage force (F) bits this permits the controller to move to any of these force bits without causing a plan compliance fault to be raised.

A similar effect can be achieved by inhibiting plan compliance checks in plan preparation. However, use of the Gap Out facility is normally preferable as plan compliance inhibit signifies the UTC System has reduced control over the controller.

(11) Green-Wave Active - GA

The "GA" control bit is sent to a junction configured with this bit whenever a green-wave is active on that junction. Its function is to inhibit any local hurry call that may override the green-wave.

(12) Flashing Amber Mode - FF

The "FF" control bit is sent to a junction configured with this bit to force the flashing amber mode. If configured with the FR reply bit this should be

⁹ The original specification was the UK DTP spec. FEB70. The current version is contained in MCE 0141.

¹⁰ The IRN is the Internal Reference Number for that equipment. It is the number by which the equipment is known within the System. If required, the IRN can be obtained by listing the data or through an operator command.

returned by the controller after it has changed to this mode, otherwise the G1 and G2 bits should be returned simultaneously.

(13) Extension Permit - EP

The "EP" control bit is sent to a junction configured with this bit to allow the extension of a stage to service bus priority

7.1.3 Junction Reply Bits

(1) Stage Reply Bits - Gn

The "G" reply bits indicate to the System which stage is running. Normally the bit appears when the last phase is operating and clears when the first phase enters its intergreen.

The "G" bits are used to verify that the controller is correctly responding to control from the "F" bits, see sections 7.1.2(1) and 7.13.

If both "GA" and "GB" are present then a 'signals off' fault is reported, see also section 7.1.3(6).

(2) Stage Demand Confirmation - DRn

Up to two (or eight¹¹) "DRn" reply bits can be used to indicate whether there is an on-street demand for a particular stage "n". These are used to ensure that the demand is serviced the next time the controller is given the opportunity.

(3) Part-time signals confirm - OL

See section 7.1.2(4).

(4) Detector Fault - DF

The Detector fault detection facility in a controller (DFM¹²) is designed to indicate the state of controllers' VA¹³ detector fault bits. If a failure is detected then the "DF" reply bit can be set in the OTU's reply word and this reports that there is a fault with the detectors connected to the controller. If this bit is present then consideration should be given to using one of the demand bits, "DX" or "Dn", to minimise the adverse effects, such as non-appearance of a stage.

(5) Sub-sequence Demand indicator - SD

This facility uses the "SD" reply bit to allow an on-street demand to cause the System to select one of two stage sequences written into the current fixed time plan¹⁴. The choice to be made by the System is indicated by the controller setting or clearing the "SD" bit in its reply word. The bit can be the result of a demand for a particular controller phase or stage, or it might be the output from a queue logic board or other two state device.

¹¹ See footnote for section 7.1.2(1)

¹² DFM - Detector Fault Monitoring

¹³ VA - Vehicle Actuated

¹⁴ Note that Sub-sequences are not available under SCOOT control.

(6) Lamps Off - LO

- (i) The "LO" reply bit is used by a controller to report its 'signals off' state. See also section 7.1.3(1).

(7) Hurry Call - HC

This facility allows the implementation of a controller's own hurry call facility to be monitored and reported to the System Log, unless the logging of hurry call messages has been suspended. The controller must be configured to return the hurry call ("HC") reply bit whenever it activates its hurry call facility. This indicates a locally sensed demand for a particular right of way at a controller, such as an emergency route, or light rail vehicle pre-emption.

A hurry call inhibits plan compliance checking whilst the "HC" bit is on and for 4 minutes after it clears. On most Systems the Stage Control "F" bits continue to be sent whilst the bit is on. However, the System can be modified by STC so that the Stage Control bits are not sent.

(8) Emergency Vehicle - EV

This facility uses the "EV" reply bit and is functionally equivalent to the Hurry Call facility, section 7.1.3(7).

(9) Clock synchronisation confirm - CS

See section 7.1.2(7).

(10) Synchronise group time confirm - SR

See section 7.1.2(9).

(11) Fall-back mode confirm - FC

See section 7.1.2(8).

(12) Local-link confirm - LC

This bit is currently not processed by the System.

(13) Controller Fault - CF

The "CF" reply bit is used to report a fault in the controller. When the bit is detected by the System a fault is reported. In the UK it is used by MCE 0141 controller to report a fault in its internal fault log and can only be cleared by interrogation of the controller through its local handset facility.

(14) Lamp Fault - LFn

The "LF1" and "LF2" lamp failure reply bits in the controllers reply word are used by a local lamp monitoring unit to report two types of lamp faults: lamp failure and a red lamp failure. "LF1" by itself is associated with the lamp failure fault whilst "LF2" is associated with the red lamp failure. The two bits form a hierarchy such that only one fault is reported at any one time.

By redefining the message texts during Data Entry these bits could be used to report other lamp fault conditions, such as "red lamp out" and "all red lamps on one phase out".

An additional "LF3" lamp failure reply bit is available as a configurable item. See section 2.3. "LF3" is associated with the unidentified lamp fault.

(15) Group 1 Indication - GP1

The "GP1" reply bit is output by some types of controller at the start of its group 1. This is then checked during controller checks, section 7.14, to ensure that all such controllers are synchronised, see also section 7.1.2(9).

(16) Remote Reconnect - RR

When the System sees an "RR" reply bit it isolates the controller and reports a fault. Normally when the RR bit is set the UTC System will not monitor the controller for faults. However, the System may be configured (S) to generate the appropriate fault messages when the MC, EV or HC bits are set.

When the bit clears all faults associated with the controller and its OTU are cleared, the clearance is reported and the controller's isolation cancelled. Maintenance personnel normally use this facility after having fixed a fault. In the UK a controller can be configured so that the bit is set when the mode switch in the controller is moved away from its normal position.

(17) Manual Control - MC

The presence of the "MC" reply bit in a controller's reply word indicates to the System that the controller has been taken out of the normal UTC mode and is in the Manual Control mode. Its action is similar to the remote reconnect facility, section 7.1.3(16), except that its disappearance does not clear the faults for equipment on the OTU. It is normally used to indicate that the police have taken manual control of the junction.

(18) Pedestrian Inhibit- PI

The presence of the "PI" reply bit in a controller's reply word for 3 or more consecutive seconds raises a non-isolating fault and outputs a message to the System log. When the bit disappears for 3 seconds or more the fault is automatically cleared and a message output to the log. Plan compliance continues whilst this fault is active and if the pedestrian stage was demanded by the computer then the junction has a plan compliance fault raised.

(19) Test Facility- TF

The presence of the "TF" reply bit in a controller's reply word indicates to the System that the controller has been taken out of the normal UTC mode and is in the Test Facility mode. Its action is similar to the remote reconnect facility, section 7.1.3(16), except that its existence for 3 or more seconds raises a non-isolating alarm and outputs a message to the System log, and its disappearance outputs a message informing the end of the test facility. It is normally used to indicate that the junction is being tested.

(20) Solar Bright confirm - SB

NOTE: This and the Dimming Confirm bits are mutually exclusive - only one is available on a system at a time, being defined in the System configuration.

The presence of the "SB" bit signifies that the controller lights are at full brightness. Two times are associated with the SB bit at which its current state is verified. At the night-time value 03:00 (B) the SB should not be sent by the controller unless the SO bit is sent by the System. At the daytime value 12:00 (B) the SO bit should be received from the controller, regardless of the SO bit being sent.

(21) Dimming Confirm - DC

See note for Solar Bright bit.

This functions in exactly the opposite manner to the SB bit. The presence of the "DC" bit confirms that the controller lights are dimmed. At the night-time value 03:00 (B) the DC should be sent by the controller unless the SO bit is sent by the System. At the daytime value 12:00 (B) the SO bit should not be received from the controller, regardless of the SO bit being sent.

(22) Flashing Amber confirm - FR

This confirms the controller is in the flashing amber mode. See the description on FF in section 7.1.2(12).

(23) Battery Fail - BF

The presence of a BF bit in a controller's reply word indicates that the battery in a set of battery powered signals is failing.

(24) Bus Demand - BDn

A maximum of 4 BD bits may be configured for a controller. The presence of a BD bit in a controller's reply word indicates that a bus has generated a demand to allow it to pass more easily through an intersection.

If the BD bit is associated with a SCOOT link, the demand is passed to SCOOT for it to service the demand.

If the BD bit is not associated with a SCOOT link, the UTC System assumes that the local controller will service the demand in a similar manner to a Hurry Call (HC).

(25) Extension Confirm – EC

This bit indicates that the controller is extending the current stage to service bus priority

(26) SA LRT Surge Protection Status

This bit indicates an LRT surge protection failure.

(27) AR LRT Artificial request status

This bit indicates the status of an LRT artificial request.

(28) DFM LRT Detector Fault

This bit indicates an LRT detector fault.

(29) LOSLRT Outstation Status

This bit indicates the status of an LRT Outstation.

7.2 Pelican Interface

7.2.1 Pelican Control Bits

(1) Hold Vehicle Phase - PV

The "PV" control bit is sent by the System to hold the pedestrian crossing on vehicle green. It is released for a few seconds by a fixed time plan or SCOOT in order to allow the pedestrian stage to start. Unless configured differently, the "PV" bit is released for 2 seconds. This is called a window.

(2) Simulate Pedestrian Demand - PX

The "PX" control bit allows the operator to force the pedestrian stage. This is normally used to allow pedestrians to cross the street when a detector fault occurs, or to force the pedestrian stage for traffic engineering reasons.

(3) Switch part-time signals on or off - SL

See section 7.1.2(4).

(4) Solar switch override - SO

See section 7.1.2(5).

(5) Synchronise Controller time - TS

The "TS" control bit allows the System to synchronise the real time clocks of all suitably equipped MCE 0141 controllers, thus ensuring that co-ordination is maintained when the System is off-line. At a pre-defined time the bit is cycled through a "101" sequence by the System, and those controllers with this facility set their internal clocks to the pre-defined time on the leading edge of the second "1". This action is confirmed with the "CS" reply bit. The pre-defined times are configured for each junction individually.

An additional facility can be configured for each controller such that the number of seconds' reply of the TS bit determines the day-of-week in the controller's internal clock.

7.2.2 Pelican Reply Bits

(1) Vehicle Green Confirm - GX

The "GX" reply bit indicates that the vehicle stage is running. This is checked by the System for compliance with the state of the "PV" bit, section 7.2.1(1). If the "GX" bit does not disappear following the use of the "PV" window when a pedestrian demand is present, section 7.2.2(8), then a fault is reported. The duration of the "Not GX" period is checked against the System data and any discrepancy reported. If "GX" does disappear when an "PV" bit has not occurred then a fault is also reported.

Two additional tests make use of the lamp fault reply bits (see section 7.1.3(14):

A signals off fault occurs when GX is absent and both lamp fault bits are present for more than 60 seconds.

A *signals such* fault occurs if GX and both lamp fail bits are absent for more than 60 seconds.

(2) Pedestrian Confirm - PC

The "PC" reply indicates that the pedestrian stage ("green man") is running.

(3) Part-time signals confirm - OL

See section 7.1.3(3).

(4) Emergency Vehicle - EV

See section 7.1.3(8).

(5) Detector Fault - DF

See section 7.1.3(3).

(6) Lamp Faults - LFn

See sections 7.1.3(14) and 7.2.2(1).

(7) Remote reconnect - RR

See section 7.1.3(16).

(8) Wait Confirm - WC

The "WC" reply bit indicates that there is an on-street demand for the pedestrian stage. This is then used to check that the pedestrian controller is operating correctly, i.e. it responds to pedestrian demands and also registers pedestrian demands. Failure to respond to pedestrian demand or a lack of the demands over a set period (see 1.3.1(a)) cause the pedestrian controller to be set faulty.

(9) Hurry Call - HC

See section 7.1.3(7).

(10) Lamps off - LO

See section 7.1.3(6).

(11) Test Facility - TF

See section 7.1.3(19).

(12) Solar Bright Confirm - SB

See section 7.1.3(20)

(13) Battery Fail - BF

See section 7.1.3(23)

(14) Bus Demand - BDn

See section 7.1.3(24).

(15) Clock synchronisation confirm - CS

See section 7.1.2(7).

(16) Controller Fault - CF

The "CF" reply bit is used to report a fault in the controller. When the bit is detected by the System a fault is reported. In the UK it is used by MCE 0141 controller to report a fault in its internal fault log and can only be cleared by interrogation of the controller through its local handset facility.

7.3 Master Cycle Counter

Under fixed¹⁵ time control the System uses this counter to synchronise all equipment that is on a common cycle time, or multiple of it. The counter is incremented once a second and the remainder after dividing it by the cycle time is the time now in the cycle for that cycle time. This means that controllers with a common cycle time are synchronised, even if they are in different sub-areas. The value is calculated from a fixed reference time and date.

7.4 Relative Priority of Control Methods

The System contains a number of control strategies, such as fixed time plans, SCOOT, green waves, Automatic Plan Selection. These may all be requested simultaneously for a junction and a priority system is used to determine which strategy is actually implemented. The System knows which strategies have been requested and implements the highest priority strategy. If this strategy is cancelled then the new highest priority strategy is implemented. The priorities, in descending order are:

- green waves
- remote requests
- operator imposed controller checks (see section 7.14)
- operator imposed fixed time control
- diversions
- timetable imposed controller checks
- automatic plan selection
- SCOOT¹⁶
- timetable selected fixed time control

7.5 Signal Co-ordination by Fixed Time Plans

7.5.1 Introduction

A fixed time plan is a sequence of stage control bits which is repeated until changed by an operator command, or timetable/CAST action.

This section describes fixed time plans, in particular the local plan, implementing fixed time plans, preparing the data and making temporary amendments to stage

¹⁵ The Master Cycle Counter is not used for controllers under SCOOT control.

¹⁶ The System does not differentiate between operator and timetable activated SCOOT control

timings and offsets. Also of interest may be the information on green waves in section 7.6, Automatic Plan Selection (APS) in section 7.10, and Diversions in section 8.6.

7.5.2 Fixed time plans

Fixed time co-ordination of traffic signals is achieved by using pre-calculated sets of timing for cycle times, splits and offsets at all junctions and pedestrian controllers in the controlled area. The calculation process is carried out remotely from the System using measured traffic volumes, and may be based on the output from a traffic modelling package such as TRANSYT.

Several sets of timings are required to deal with different traffic situations, allowing for marked changes in volumes, changes in turning movements and for any tidal flow effects during the day or during special events. Each set of timings is called a "traffic plan" and there are usually separate plans to cover parts of the day such as the morning peak, off peak, evening peak, etc. If necessary the controlled area may be broken up into parts called sub-areas so that different plans can be used in each sub-area.

Each plan may not require the control of all equipment in the controlled area or sub-area. In this case the uncontrolled equipment is specified as being under local control.

7.5.3 Local Plan

The local plan is known in the System by the number 0. The user cannot configure this plan. If used, then no stage control bits are sent to the selected controllers.

7.5.4 Preparing the data

Plan data is stored in files on the System disc. For each item of equipment the plan may define:

(1) CONTROL mode

For this mode the cycle time and stage start times for each junction controller are defined. For a pedestrian controller the start time of the pedestrian window and its duration are defined.

(2) LOCAL

In which case the equipment is under local control.

(3) Local link inhibit

The "LL" bit and no Stage Control bits is sent.

(4) Fall back mode

Which indicates that the "FM" bit and no Stage Control bits are sent.

(5) Part-time signals switched off/on

Which indicates that the "SL" bit and no Stage Control bits are sent. The significance of the "SL" bit depends upon the user configured state for part time operation.

(6) An optional plan description field may be completed with a textual description of any changes made.

7.5.5 Temporary Amendments

The System provides a facility for varying an implemented plan¹⁷. This allows the stage durations, offsets and cycle time to be modified. Once the plan has been changed it is treated by the System as an operator imposed fixed time plan; this means that the next timetable action to select SCOOT or another fixed time plan will fail causing an operational alarm.

7.6 Green Waves

7.6.1 Introduction

The green wave facility is intended to control a number of junctions and/or pelicans so that a vehicle travelling on a predetermined route may pass through the junction or crossing with minimum delay. Typically it is used to provide a quick means for fire engines to get from their base through the city to the area of a fire. It could also be used to provide a smooth path for an ambulance carrying a critically ill patient, or for VIPs. Equipment for a particular green wave can be associated with any number of TCCs.

Individual controllers are only affected just before and whilst the vehicle passes through. The green wave can be operated for controllers under fixed time or SCOOT control. If Controller Checks is active the checks are abandoned in favour of the green wave, see section 7.14.

The System allows a route to be called again before the first call has been completed. This has the effect of initiating another wave down the route.

If more than one route attempts to use the same controller at the same time then the first request is honoured and no warning given that the second, or third, wave has not been honoured.

7.6.2 Defining the route

In order to access the route an SCN must be created for it. Once this is done a special "plan" is created. The plan defines both the controllers affected by the green wave and what they are expected to do during one. This is defined in terms of the duration of time a specified stage is held and when it should start, timed from the beginning of the wave.

The duration is typically set to 60 seconds. This gives time for the current stage to complete its minimum, the intergreen and a clearance period to have occurred before the vehicle arrives and a 30-second leaving window to the vehicle.

It is a normal requirement of each controller on the route that the stage to be used for the green wave must be accessible from all configured controller stages. If this is not true then the controller moves through the stages in a cyclic order until the

¹⁷ The temporary data created using these commands is stored in plan 47. Consequently no data can be entered for plan 47 nor can it be prepared.

green wave stage can be called. Should the chosen stage be demand dependent, the System can be configured to set the appropriate demand bit when the stage is forced.

A clearance stage can be specified for the equipment that will be run when the green wave stage terminates.

The Time and Distance Diagram, see section 9.3.4, can be used to refine the data for a route using the green wave mode.

7.6.3 Starting a Green Wave

A green wave route can be activated by either an operator command or by a remote request, see section 8.2. In the latter case this is normally achieved using a route selection box, section 14.3.6.

Each remote request is associated with a single green wave route. The System allows the "plan" associated with a route to be changed by operator command or by time of day. This allows the timings to be varied to cope with different traffic conditions.

For routes selected by remote request equipment 'route running' bits may be optionally returned to the OTUs. These can be used to light a lamp on a route selection box, section 14.3.6.

Green waves terminate when their actions are complete. Alternatively, green wave requests may be cancelled by an operator command.

7.6.4 Primed Green Wave

This form of the green wave was introduced as a special customer requirement. The meaning of 'primed' is that a green wave route should be selected to run by operator command, but does not actually start until a button is pushed in the fire station just before the fire engine departs. Priming the green wave uses a special facility to light a lamp on the fire station control panel. (The lamp is steady, not flashing, as it would be for a normal delayed green wave). This action starts a simulated remote request. The push button on the fire station panel is then used as an 'EV' bit to start the green wave, which then proceeds as normal.

Note, this is the reverse of the normal remote request green wave, in which a button on a panel is pushed first, in order to select a green wave route. It is a little like a delayed green wave, in which the route is only started when an 'EV' bit is activated by the departing fire engine passing over a loop.

The simulated remote request needs to be created in the database, as the RQ data entry contains the green wave SCN, green wave route number, EV outstation and bit number and special facility SCN, but the RQ bit is not attached to a outstation, so the outstation reference is zero.

7.7 Manual Waves

The Manual Wave facility is an extension of green waves. It provides operator control of a green wave through a live update display. Every equipment configured on the selected green wave is displayed, showing the current running

stage, the stage called for in the green wave and whether it is isolated. The operator can select an equipment and start the green wave stage by pressing a defined function key. If the equipment is not isolated or disconnected from the System because of lack of communication with the respective TCC the green wave stage is forced and held. Once the stage is running the timer displayed on the screen counts down from 180 (B) seconds after which the controller returns to the previously running plan. This countdown period can be cancelled by pressing another function key or, before the countdown has reached zero, be reset to 180 (B) seconds again by pressing the previous key.

Any number of equipments on the manual wave can be forced to run the green wave stage, their start and finish times being completely independent of other equipment also being forced.

Only one manual wave can be active at any one time.

The maximum number of equipments on one manual wave is 64. This number can comprise equipment on any TCC.

The move from the current running plan to the green wave stage is made through the normal cyclic order if the controller is unable to move directly to the stage. If, whilst at one of the intermediate stages, a move to the green wave stage is allowed then this is forced.

A clearance stage can be specified for the equipment when it terminates the green wave stage.

7.8 Manual Hurry Call

The Manual Hurry Call facility allows the operator to force a stage of a junction or pelican controller for up to one minute by operator command. A maximum of five controllers may be specified in a single command.

A Manual Hurry Call can be cancelled immediately.

7.9 VIP Routes

The UTC System may be configured (B) for either of the two types of VIP route, single vehicle or convoy. The VIP route is implemented as a special type of green wave and may be initiated in the same ways. For either type of VIP route, a convoy length must be specified during data preparation. This convoy length is used as the stage length for all the controllers specified on the route.

7.10 Automatic Plan Selection (APS)

7.10.1 Introduction

Automatic Plan Selection is used to select a fixed time plan on a sub-area basis when pre-defined traffic conditions are met as defined by the state of specified queue, occupancy and count (volume) detectors. SCOOT loops, configured as pseudo count detectors, may be used as occupancy and volume detectors.

In order to avoid frequent plan changes adversely affecting the on-street situation the calculations are made every 15(U) minutes.

All equipment required for a particular APS strategy must be associated with one TCC. This means that you cannot use detectors from more than one computer to drive the algorithm for a sub-area.

Because of the complex nature of this facility the System provides for running APS in "test" mode, which means that although plans are selected, they are not implemented.

7.10.2 Detector States

Each detector can be either TRUE or FALSE. A queue detector is set TRUE when a queue forms on the detector. Other types of detector are set TRUE when a trigger threshold is exceeded.

7.10.3 Group States

The various detectors are combined into three groups, one for queue, one for volume and one for occupancy, these groups are again either TRUE or FALSE. A group is seen as TRUE when either all detectors in the group are TRUE or at least one is TRUE. This choice is determined during data preparation.

7.10.4 Plan Selection

For each sub-area these groups are then combined using Boolean logic in up to 6 expressions. Each of these expressions select a "plan priority".

7.10.5 Plan Priority

These are used to allow different plans to be implemented when different circumstances arise. The System implements the highest priority plan whose Boolean expression is TRUE.

7.10.6 Actioning of CASTS by APS

The user may specify a CAST to be actioned as well as, or instead of, a plan change when a particular set of conditions occur.

7.11 Signal Co-ordination by SCOOT

Note: licensed facility - see section 2.3.

This section is a brief description of SCOOT. For more information see the SCOOT User Guide (reference 1.3.2(e)).

SCOOT is an algorithm that uses information from on-street detectors to optimise the cycle time, offset and splits for each controller connected to the System. The area to be controlled is sub-divided into regions. All controllers in a region run at either the region cycle time or half the region cycle time. It is possible to move nodes from one region to another by command if required.

Within a region the unit of control is a node. A link, which is an approach to a node, can have one or more detectors associated with it. The link is used to change the appropriate stage duration. The System also allows more than one UTC stage to be associated with a SCOOT stage, thus allowing for fixed time clearances or pedestrian stages. See section 7.12.

In most cases, each controller, whether junction or pedestrian, is associated with one node. However, the System does allow more than one controller to be associated with a node. This is particularly useful when the controllers are close together.

7.12 SCOOT Translation Plans

SCOOT translation plans define the relationship between the SCOOT stages and fixed time stages for each controller on the node. These plans are prepared as part of System data preparation.

Normally a 3 stage controller has three SCOOT stages with a one to one stage correspondence between UTC and SCOOT. The System allows for up to 2 (or 8 - see section 2.3) stages to be demand dependent in a similar manner to fixed time control. If a fixed period is required for a particular stage, such as a car park exit, then this stage may be combined with another stage to create one SCOOT stage. This "2 UTC stage" SCOOT stage then appears on-street as a fixed period UTC stage plus a variable period UTC stage and the 4 UTC stage controller appears to SCOOT as having 3 stages. This approach does require careful calculation of the start and end delay for each associated SCOOT link.

In some circumstances it is desirable to operate two or more controllers as one SCOOT node, typically where they are too close together to have loops on the internal links. The System achieves this by allowing a controller to be associated with a sub-set of the SCOOT stages and other controllers to be associated with the rest of the stages. In this manner all controllers referencing a SCOOT stage make the required moves at the same time. Using the fixed period mentioned above allows fixed offsets to be introduced between controllers in "multi-equipment" nodes.

7.13 Plan Compliance Faults

7.13.1 Introduction

The Plan Compliance fault detection facility is designed to allow the operation of both intersection and pedestrian controllers to be monitored. Checks are made against the various controller timings stored in the System data and any departures reported as faults. The controllers are also monitored to check that they obey the control commands sent out by the System.

Plan compliance checking is inhibited for 4 minutes after a new mode of control is requested at a site. This gives the controller time to respond to the new control algorithm (i.e. get in step).

If a fault is detected the fault log is updated, a message sent to the System Log and the equipment isolated. The System has a command that allows this isolation to be inhibited. The System may be configured (S) such that, if isolation is inhibited, only the first occurrence of a plan compliance fault is reported or all such occurrences are reported.

7.13.2 Intersection Controller Continuous Checks

For all modes of operation the duration of each controller stage inter-green is compared with the minimum and maximum times stored in the System data. Any departures from the durations are reported as a fault.

In addition the following faults due to a controller responding incorrectly are checked for:

- a) stage forced and confirmed and the confirm bit disappears,
- b) stage forced and a different stage confirmed.

7.13.3 Under Fixed Time Control

For controllers under fixed time plan control, the duration of each controller stage green time is continuously measured, compared with the planned time and a fault reported if a discrepancy of more than a configurable number of seconds is observed.

7.13.4 Under Local Control

For controllers under local control, the duration of each controller stage green time is checked against the minimum green and intergreen times stored in the System data and any violation reported as a fault.

7.13.5 Pedestrian Controller Checks

The duration of the controller's green to vehicles period is measured and, if less than the value stored in the System data by more than a configurable number of seconds, a fault is reported.

The duration of the controller's non-green to vehicles period is measured and, if less than the lower value or greater than the upper value specified in the System data plus or minus a tolerance of 1 second (B), a fault is reported.

Between 1900 hours and 0700 hours every day pedestrian controllers are monitored for a permanent demand fault over a continuous 6 hour period and a fault is reported if this is found. It is possible to clear the fault manually or by the detection of no pedestrian demand. Similarly between 0700 hours and 1900 hours pedestrian controller is monitored for non-operation and faults are reported and cleared in a similar way.

In addition the following faults are continuously checked for:

- a) green to vehicles disappearing after the hold vehicle bit is set for more than 3 seconds,
- b) green to vehicles failing to disappear within 5 seconds of the hold vehicle bit being cleared with pedestrian demand bit present.

If either of the above occurs, a fault is reported but the controller is not isolated.

7.13.6 Intersection permanent demand checking:

If a demand dependent stage runs during every cycle for a 60 minute period it is deemed to have a permanent demand and a permanent demand fault will be raised.

If permanent demand checking is set to monitor all stages of an intersection and that intersection is under local control and the stage has appeared every cycle and every time has run for the maximum time configured in the UTC data base then a permanent demand fault will be raised.

7.14 Controller Checks

7.14.1 Introduction

The Controller Checks facility allows either all intersection controllers connected to the System to be checked on a regular basis, or individual controllers to be checked at operator request.

7.14.2 Timing of checks

Regular checking is accomplished by entering the Controller Checks command in the System timetable for each day, or one or more days in the week or month, depending on the frequency of checking required. It is usual to schedule this command for a time of day when the road network is lightly loaded, typically, in the early hours of the morning. Up to 6 (B) controllers connected to each TCC may be being checked at the same time. Controllers previously isolated by a fault are not checked. Fixed time plan or SCOOT control are temporarily suspended whilst checking is in progress.

Checking of controllers stops automatically when all controllers connected to the System have been tested or when the stop time is reached. This stop time is identified by placing a Controller Checks stop command in the timetable, usually at the time when the road network is likely to become busy again. Testing of the current controller is always completed before termination. Any controllers not tested when the stop time is reached are checked when Controller Checks is next run from the timetable. It is always advisable to put the cancel Controller Checks command in the timetable to occur well before normal traffic flows start.

7.14.3 Interruption by higher priority

If during controller checks a higher priority mode of control is called on a junction or junctions then controller checks are suspended on that equipment. When all the other junctions have been checked then controller checks should return to these junctions and try a second time. Should it be impossible to complete the checks then a message is output.

Higher modes of control can be:

- a) hurry call
- b) green wave
- c) manual wave

d) operator imposed plan

e) Operator Control

The operator is provided with a command to start Controller Checks on a single intersection controller. Checking can be terminated by another operator command. Any discrepancies that are detected are reported to the terminal from which the command was input.

7.14.4 Duration of Individual Tests

Controller Checks is run for a maximum time on each controller which is configurable in the System data. If testing of a controller is aborted because of this limit a fault is reported and testing continues with the next controller. Irrespective of the outcome of the tests, all demand and force bits are cleared before the controller is returned to service.

7.14.5 Potential Problems

Certain controllers may have alternative moves that are not in the System data and not reported to the System, such as a special VA stage. If the controller itself instigates an alternative move whilst Controller Checks is running a fault is reported due to incorrect stage lengths or intergreens.

7.14.6 Data that is Checked

The tolerances to be applied to the measured times, excluding scan time, are configurable in the System data and are usually:

Minimum stage green times	+ 1 second
Intergreen times	+ 1 second
Maximum stage green times	+ 2 seconds

Individual controllers may have a range of timing values configured for the above tolerances in the System data.

The following tests are performed on each controller.

- a) Minimum stage green times - by forcing and, if necessary, demanding each stage in turn in the order defined in the System data. Once the stage green confirm bit is released by the controller, the force, and where appropriate, demand bit is transmitted for the next-but-one stage. It is possible for the test to start at any stage in the sequence to avoid the delay of waiting for a specific stage to be reached. The sequence can contain up to 18 stages.
- b) Maximum stage green times - by setting the common demand "DX" bit in order to call each phase, extension and stage. The duration and correct sequencing of each stage is checked. The sequence can contain up to 12 stages ordered so that testing commences directly after the minimum stage green tests without delay.

NOTE: If no "DX" bit exists for a controller, the maximum stage green timings check should be inhibited in the database preparation junction form.

- c) Secondary maximum green times - this facility is used to check the duration of a stage that would not normally be in the controller's fall-back plan when the checks are in progress. The stage is forced to occur using the appropriate "F" bit. When the intergreen is seen the force bit is cancelled and the other demand bit(s) are set. The duration of the stage is then measured, allowing up to 2 stages to be checked.

During each of these tests the stage to stage intergreen times are also measured.

Each timing is checked only once against the System data during the test, with each discrepancy being reported by sending messages to either the terminal specified in the timetable command and the System Log, or the terminal from which the operator command was input.

If initiation of a green wave plan interrupts the testing of a controller, or any data transmission faults are detected during Controller Checks, checking of the controller in question is terminated. If being checked as part of the System wide checking, initiated through the timetable, the controller is marked as untested and re-tested when controller checks is next run.

Controllers that have discrepancies are not isolated and are returned to the currently requested mode of control when checking is complete.

When a controller has been checked once it is not checked again, except by operator command, until all other controllers connected to the System that are not faulty or isolated have been checked.

7.15 Link Lists

A link list consists of a number of intersections and Pelican controllers that are intended to maintain co-ordination at all times.

Two types of controller are defined for a link list - master and slave controllers. A link list may consist of a number of master and slave controllers. If a master controller or master Special Facility (section 8.1) is isolated by fault, then all controllers and special facilities with the same link list number are also isolated.

8. OTHER STREET EQUIPMENT INTERFACE

8.1 Special Control Facility

This facility has a variety of uses. Traditionally it was used to control 'secret signs' inhibiting traffic movements by time of day. Now it is commonly used to indicate that a Remote Request (see section 8.2) has been seen by the UTC System and that action is in progress. Typically this is used to indicate that a green wave is in progress on a green wave Panel (see section 14.3.6).

A special facility may also be associated with a Junction or Pelican, so that when a particular SCOOT or fixed plan is running on the associated controller, the special facility is turned on. The special facility can be included in an appropriate link list (see section 7.15).

8.2 Remote Request Facility

When a Remote Request bit(s) is/are set on an OTU, it/they can be used to remotely set various UTC facilities. Such facilities are:

1. A fixed time plan
2. A diversion
3. A green wave route
4. A bridge has been raised
5. A bridge has been raised and an associated diversion implemented
6. A fog detector has detected fog
7. A bus is requesting priority in conjunction with an HPW bus system
8. A single vehicle VIP route
9. A convoy VIP route
10. Data from a SIETAG bus information unit
11. The output of user defined messages.

A Type 1 Remote Request can be inhibited from appearing in any log, by setting both the plan number and sub-area to 0. The associated Special Facility may be situated on any OTU.

8.3 Collection of Traffic Data

This facility provides for traffic count and occupancy data collection using on-street hardware such as loops, vehicle detectors and associated logic boards connected via OTUs to the control centre.

Detector data can be displayed using operator commands in aggregated counts for 5 minute, or for 15 minute, hourly, daily and weekly aggregates. It is also possible to display the 5 minute counts and occupancy collected during the last 60 minutes as a live update display.

The weekly summary file remains on the disc for a number of weeks configured in the System data, after which time it is deleted. It is possible to transfer the file

to a suitable PC workstation prior to its deletion for further processing off-line. See section 10.2.

Count information can be obtained from SCOOT detectors by providing the System with the number of vehicles detected in a specific interval of time. The System uses this to derive a conversion factor from LPUs to vehicles for that link, which is then used to determine vehicle counts, these being processed in the same way as count detectors. A scaling factor is configurable for each detector, which is set up in the data preparation process.

When count detector data is incomplete the count from the preceding week for the period is inserted in the data file and marked as "previous" data. If no such data exists then a zero value is inserted and marked as no data available for the period.

Moveable count detectors have a single count (VC) bit and have a scale factor of 0 which means that the count value only increments when the state of the VC bit changes from 0 to 1 (the leading edge); no change of count is recorded when the VC bit changes from 1 to 0. The moveable count detector can be moved to monitor a reply bit on different OTUs by means of an operator command.

8.4 Congestion Detection

8.4.1 Introduction

There are two forms of congestion detection: queue and occupancy, described below.

8.4.2 Queue Congestion

The queue detector is a single bit that when on indicates that a queue has been detected on-street. An operational alarm is raised when this occurs. It is possible to inhibit the alarm from specific plans if queues are expected to occur.

8.4.3 Occupancy Congestion

A count detector may be configured with an occupancy bit and this allows the System to calculate what percentage of time the loop is occupied. This is achieved by a unit that samples each detector 25 times per second. Every time the detector is occupied a counter is incremented. Bit 5 of the counter (starting at bit 0) is returned to the System in the OTU reply word. This means that the bit changes state every time the unit has seen thirty-two twenty-fifths of a second of occupancy.

The sequence of bit changes is then processed to determine the percentage occupancy. The 'Congestion Formed' alarm is raised when the averaged occupancy reaches the 'Up Threshold' for the detector. Similarly, the 'Congestion Cleared' message is output and the alarm cleared when the falling averaged occupancy reaches the 'Down Threshold'. The threshold values and the smoothing factor used to calculate the average occupancy from the current and previous occupancy values are configured during the data preparation process.

The threshold values may be changed by operator command, timetable and CAST.

8.5 Car Park Information System

8.5.1 Introduction

The car park information facility directs motorists to the car parks that have vacant spaces. This is achieved using hardware in or near the car parks to provide data from which the degree of car park occupancy can be calculated. A number of threshold values are used to determine the appropriate car park state, which is then used to drive car park signs. It is possible for these signs to be associated with a number of car parks, for example: short stay, long stay, inner city, park and ride, so that a particular parking philosophy may be imposed.

8.5.2 Operator Control

Commands are provided that allow car parks to be opened or closed, to change car park thresholds or capacities, to force a car park to a particular state and to force signs to particular states.

Some types of car parks have a "closed bit" that allow car park attendants to close or open their car parks. Such car parks can only be open or closed through this mechanism.

Car park state changes are always reported by messages at the operator terminal, and written to the System log.

8.5.3 Car Park States

A Car park can have the following states:

- SPACES
- ALMOST FULL
- FULL
- CLOSED
- FAULTY

In addition it can have the following entrance states:

- FULL
- SPACES.

The System provides two ways of determining the state of a car park. Firstly an intelligent unit in the car park that tells the System what state it is in and secondly the state may be determined from the number of cars in the park, known as the occupancy (see section 8.5.4).

If the occupancy is increasing and it is greater than the "almost full increasing" threshold and its current state is SPACES then the state is set to ALMOST FULL. If it is greater than "full increasing" and its current state is ALMOST FULL the state becomes FULL.

If the occupancy is decreasing then a similar check is made with the two "decreasing" thresholds.

A car park's entrance state is determined by comparing the occupancy with the "entrance threshold". If greater than or equal to the value then it is FULL otherwise it is SPACES. If the entrance threshold has not been specified, the "full increasing threshold" is used instead.

When the detectors used for determining a car parks occupancy are faulty then the car park is set to FAULTY, when the fault clears the occupancy is taken from the 'weighted averages' file (see section 8.5.4).

8.5.4 Car Park Occupancy

The occupancy is determined using either:

- a) count detectors at the entrance(s) and exit(s) of the car park. The occupancy is not allowed to go below zero.
- b) a 13 bit binary coded decimal¹⁸ value returned from the car park, which cannot change by more than a configurable value in one step.

The occupancy of a car park cannot exceed its capacity.

When the System starts up or a car park becomes FAULTY the occupancy is read from the 'weighted averages' file. This file contains a weighted average for the car park's occupancy for every half-hour of every day of the week; the data is updated on the half-hour boundary every hour.

When a car park is closed the car park still has its occupancy updated if vehicles are detected entering or leaving the car park.

If a car park goes faulty, the vehicles present count (i.e. occupancy) is not updated.

For some car parks it may be advisable to reset the occupancy by time of day to a sensible value, normally early in the morning.

The historical car park occupancy for any day in the previous 7 days is available for display.

8.5.5 Car Park Occupancy Predictions

8.5.6 Car Park Groups

A car park group is made up of at least one car park. The state of the group is the least full state of any car park in the group. In the following table ALMOST FULL is abbreviated to ALMOST and as the car park C01111 moves from SPACES to FULL the resulting group state is indicated.

Car Park State

¹⁸ Binary Coded Decimal, known as BCD, represents each decimal digit as 4 binary digits. The following table provides a number of examples :

Decimal Value	Binary Value	Coded	Decimal
7	0000		0111
27	0010 0111		

C01111	C02222	C03333	Group State
SPACES	ALMOST	FULL	SPACES
ALMOST	ALMOST	FULL	ALMOST
FULL	ALMOST	FULL	ALMOST

8.5.7 On-Street Parking

The System is able to interface to On-Street Parking PCs that collect data from Pay-and-Display machines. The data received is the current ticket validity and arrives from the PCs at regular intervals.

8.5.8 Car Park Signs

The System provides for 3 types of car park signs:

- a) the entrance sign whose state is determined from the group entrance state. These signs are located at the entrances to car parks to control the inbound flow of vehicles.

If the car park is closed, the sign shows FULL.

- b) the name sign determined from the state of a single group,
- c) the city sign determined from the states of up to 5 groups.

A city sign can have the following states:

- GROUP 1 SPACES
- GROUP 2 SPACES
- GROUP 3 SPACES
- GROUP 4 SPACES
- GROUP 5 SPACES
- GROUP 1 ALMOST FULL
- GROUP 2 ALMOST FULL
- GROUP 3 ALMOST FULL
- GROUP 4 ALMOST FULL
- GROUP 5 ALMOST FULL
- FULL.

The state of a City sign is determined by examining the least full state of the car park groups assigned to it. In the example shown below only three groups, rather than the maximum of five are used.

Group1	Group2	Group3	City Sign
SPACES	ALMOST	FULL	GROUP 1 SPACES
ALMOST	ALMOST	FULL	GROUP 1 ALMOST
FULL	ALMOST	FULL	GROUP 2 ALMOST

FULL FAULTY FULL FULL

This mechanism allows one area of the city to be used first for car parking, followed by more outlying areas. Or possibly car parks on the inbound side of the city first, followed by car parks on the far side.

An operator and timetable command permits the checking and exercising of car park signs by displaying each of its possible aspects in turn.

8.5.9 System start-up

Car parks without a "closed bit" are automatically opened, other car parks use the "closed bit" to determine the state.

8.5.10 Transfer of Car Park Data to a Variable Message Sign Control System (VCS)

See section 16.18.

8.6 Diversion Control System

8.6.1 Introduction

The diversion control system is intended to advise motorists which route to take if, for instance, the sea front is flooded or a bridge closed. Once activated a diversion sends a "1" to the diversion signs for that route. Optionally diversions may be related so that the result of starting a specific diversion depends upon the diversion(s) already operating¹⁹. A diversion starting can also implement a fixed time plan for a specified sub-area.

It is possible to start a diversion remotely by associating it with a remote request.

All equipment associated with a diversion must be contained within a single TCC.

8.6.2 Groups and Types

Every diversion is associated with both a group and type, each in the range 0 to 3.

If a diversion only affects diversion signs and does not interact with other diversions or start fixed time plans then it must ALWAYS be assigned to group 0 and type 0. Other diversions are known as plan dependent diversions, and belong to group 1, 2 or 3.

Each diversion within a group has a type. If the diversion belongs to group 0 then its type MUST be 0. Plan dependent diversion groups may have up to 3 diversions within the group, and each one must have a separate type. Only one diversion in a group may be of type 1, 2 or 3.

Diversions of types 1, 2 or 3 cause diversion signs to be changed and may also invoke a plan change. Diversions of these types may interact with one another causing the starting or cancellation of a diversion of a different type but within the

¹⁹ This part of the Diversion System was intended for use when two bridges crossed a river, both of which could be closed independently. If a bridge closed then which diversion was called became dependent upon whether or not the other bridge was already closed.

same group. Diversions within the same group only invoke a plan change on the sub-area defined for the group.

8.6.3 Ripple Diversion

Ripple diversions are intended for the control of multi-state signs.

The display of a particular aspect of a sign may be delayed from the start of a Ripple diversion; this allows sign aspect changes to be "Rippled".

Within a ripple diversion, the same sign can appear more than once; for example, the first time to show Aspect 1 and some time later to show another aspect.

If a sign that is declared as essential for a particular diversion is faulty, that diversion will not be implemented.

If a sign appears in more than one diversion, that sign will display the aspect required by the latest diversion to be called.

8.6.4 Diversion States

Each diversion group is in a particular 'state'. The state defines which diversion types within the group are active (running). The state that a diversion type goes to depends on the current state and the type of the diversion to be introduced. The rules governing the state changes are defined in the Dependent Diversion Rule Tables during data preparation.

During data preparation the state of all diversions within the group is entered using a 3-digit code. The left-hand digit being 1 for diversion type 3 active and 0 otherwise, the middle bit a similar value for type 2, and the right hand bit for type 1. Hence "110" represents types 3 and 2 active, type 1 inactive.

8.6.5 Diversion signs

Each diversion sign is defined as being essential or non-essential. If a sign is essential and the sign is faulty the diversion is not implemented. If the sign goes faulty whilst a diversion containing it is active, the diversion is cancelled.

Diversion signs are assigned to one of three diversion sign groups. A diversion sign group delay is defined for each sign group. This is the delay between entering the command to start/cancel a diversion and the setting/clearing of the diversion signs on the street. The switching sign delay time depends on the diversion sign group number to which the diversion sign belongs, and the diversion sign group delay.

Three types of diversion sign may be used with the system:

- (1) A two-state sign using 1 control bit
- (2) A multiple state sign using 1 to 8 control bits and up to 254 states
- (3) A dot-matrix sign controlled via a SIESPACE system (see section 16.18).

8.6.6 Diversion plans

An introduce diversion plan delay time is defined for each diversion group in the Diversion Plan Switching Timetables. It is the delay between entering the

command to activate the diversion and the introduction of the new plan. The time used is the time defined for the state that the group goes to after the relevant diversion is introduced.

A remove diversion plan delay time is defined for each diversion group in the Diversion Plan Switching Timetables. It is the delay between entering the command to remove the diversion and the introduction of the new plan, i.e. the plan to be used after the diversion is removed. The time used is the time defined for the state that the group was in before the diversion was cancelled.

8.6.7 Operational

When a diversion of types 1-3 is introduced, the following occurs:

The current state of the group is compared with the new state of the diversion type²⁰:

- a) If the bit in the new state is set to 1 and in the old state it is set to 0, then if this is the diversion type used in the introduce command, this diversion is introduced.
- b) If the bit in the new state is set to 0 and in the old state it is set to 1, then this diversion type is cancelled.
- c) If the bit in the new state is set to the same value as the bit in the old state then there is no change for this type.

For example:

CURRENT STATE: 6 = 110

NEW STATE: 3 = 011

In the current state, diversion types 2 and 3 are active. The new state means that diversion types 1 and 3 have changed state. Hence diversion type 1 starts, diversion type 2 remains unchanged and diversion type 3 is cancelled, since in the new state it is set to 0, whereas in its old state it was set to 1 (active).

A new plan is introduced depending on the new state defined in the Dependent Diversion Rule Tables. The plan to be introduced is defined by the operator in the Plan Diversion Rules Table, which is also dependent on the time of day.

When the decision has been made to introduce and/or cancel a diversion, the diversion sign(s) is/are switched after the relevant delay times, as for sign only diversions. Similarly, any plan change is made after the relevant delay time.

8.7 Tidal/Tunnel Flow System

8.7.1 Introduction

The tidal flow system permits a central lane in a two-way highway to be used for traffic in one direction during certain times of the day and in the other direction at other times of the day. It may also be used to control the flow of traffic in the bores of a tunnel.

²⁰ The new state is defined in the Dependent Diversion Rule Tables during data preparation

8.7.2 Tidal Flow Signalling

The flow of traffic in the central lane of a tidal flow system is controlled by variable message signs, which can display one of the following situations:

- (a) a straight-on arrow, permitting traffic to use the central lane
- (b) a move-over arrow, signifying the end of flow in this direction and for all traffic using it to move back to the left hand lane(s).
- (c) a red cross, signifying no traffic is allowed to use the lane in this direction.

8.7.3 Operator Control

Commands are provided that allow tidal flow sign aspects to have the following conditions:

- (a) Double cross - no traffic is allowed to flow in either direction
- (b) Inbound flow permitted
- (c) Outbound flow permitted

A cancel command allows the tidal/tunnel flow system to revert to local control.

Both successful and rejected tidal flow commands are reported at the operator terminal and recorded in the System Log.

Commands also allow for the sending of an emergency lane closure bit and another bit to release the emergency lane closure.

8.8 SCOOT Detector Faults

Failure of a SCOOT loop is detected by the System when the loop shows a continuous presence or absence of vehicle detection over a period of time. SCOOT detectors are initially set 'suspect' when an apparent fault is discovered and then 'faulty' if it persists. Only persistent faults are logged.

Additionally a timetable command may be used to initiate the recording of SCOOT detector data for one hour and compare this with previously recorded data for the same time in the previous week, i.e. overcounting or undercounting. Any significant differences are reported in the output file and the operator may then decide to set the detector faulty. The report produced gives a break down of the flow in LPUs over all SCOOT detectors for a single hour, which is contrasted with the previously recorded data.

If a data transmission system OTU becomes faulty, any SCOOT detectors connected to it have continuous presence simulated and are set faulty.

The System contains four user configurable thresholds, for suspect empty, suspect full, fault empty and faulty full. These are defined in numbers of minutes.

8.9 Other Equipment Faults

The detection of faults on other items of on-street equipment is usually applied to signs and other pieces of equipment known to the System. The usual type of fault to be detected is that the equipment has not responded to the data sent out via the data transmission system.

Failure of the equipment to respond to the control data sent by the System causes it to be set faulty in the fault log and a message sent to the System Log. The equipment is also isolated and not subject to further control.

8.10 Variable Message Signs (VMS)

VMS provide early warning to motorists with information on congestion, closed roads ahead and other incidents.

The UTC System controls Variable Message Signs by treating them as either direction signs or as car park signs.

Control of VMS by operator override is provided by a set of commands.

8.11 Analogue Sensor Interface

Analogue sensors that measure pollution levels and other environmental conditions provide information to the UTC system for analysis and storage.

Numerical and graphical displays show the historical and current sensor values and threshold levels are set up such that alarms are raised when these are passed. The same alarms are cleared when other threshold values are reached. These threshold levels may be implemented to measure either increasing or decreasing sensor measurements; use of the latter being intended initially for warning of low temperatures.

One or more sensors of different types may be grouped together so that when all sensor measurements pass their alarm threshold values suitably configured traffic strategies may be implemented to counter the effects of pollution. Similarly other control strategies may be implemented when all sensor measurements fall below their clear threshold values. The combination of an increasing pollution level and a decreasing temperature triggering alarms and implementing control strategies is one example of the possible uses for the interface between the System and analogue sensors.

8.12 Link Travel Time

If the UTC System is configured as an ITMC, data on link travel times may be transferred to the ITMC as required.

8.13 Tram Interface

When the reply bits (maximum of 5) of a tram count detector are received in the correct sequence the count shall be incremented.

The following control bits may be sent to an OTU, associated with a tram controller:

- A maximum of 4 tram priority inhibit bits (TPn)

- An AM Priority bit (AM)

- A PM priority bit (PM)

The receipt of a TP reply bit indicates that the junction controller has given priority to a tram causes the System to suspend plan compliance checking for 4 minutes.

The TLF (tram phase lamp failure) and TCF (tram controller failure) reply bits cause suitable messages to be output to the System log.

9. DISPLAY, STATUS AND OUTPUTS

9.1 Introduction

Three types of display are available for use on the System, which are Monochrome, Colour and Graphical User Interface. These and System outputs, covering live-update displays, listings, data storage and conversion to PCs are described in this section.

9.2 Monochrome Screen Displays

9.2.1 Introduction

A number of displays are provided for use on monochrome terminals, which are described below. Each display can have a snapshot print made at any time.

9.2.2 Control and Reply Bit Monitor

This display provides, for a single OTU, or any one of the pieces of equipment connected to an OTU, 16 bits of control data, 16 bits (for TC8) or 32 bits (for TC12) of reply data, an indication of the transmission failure (if any) and to which equipment each bit is allocated.

For each change in either the control data or the reply data a new line is output above the previous data with the time of the change and the new data. When the screen is filled the oldest line of data is lost from the bottom of the screen.

In addition to the snapshot print the System provides a facility that can automatically print the data when a plan compliance fault occurs.

9.2.3 Control and Reply Bit Monitor, with override

This display provides, for a single outstation address, the same display as the control and reply bit monitor, section 9.2.2. An additional line is provided that allows the operator to modify any of the bits either continuously or as a "single-shot". Use of this facility is recorded in the System Log, section 4.13, and the System continues to analyse the reply data.

9.2.4 Control Status Monitor

This display provides, for a single intersection or pedestrian controller, the control and reply data for the selected equipment, a summary of any outstanding faults on the equipment and the current plan timings (the current event in the plan is highlighted). A history of the stage and inter-green durations is built up during the time that the display is running. The display also shows the times and plan numbers of timetable events which affect this equipment and a summary of all plans and their cycle times. If reply word analysis is inhibited for the controller, this is also shown. The operator can request the display to replace the plan cycle time and timetable information with a table showing the minimum and maximum stage durations, the allowed stage moves and the inter-greens between each stage. Either the upper or lower controller timings may be displayed. The operator can also examine the timings for plans other than the current plan by entering the plan number.

9.2.5 Detector Flow Displays

This facility allows the operator to view the last 20 counts in 5-minute intervals. The screen is updated as more data is obtained.

9.2.6 Validation Displays

The Validation Displays facility provides an aid to the Traffic Engineer during SCOOT validation especially whilst using the Roving Terminal equipment - see section 14.2.11. There are a number of displays, two for link validation and one each for node and region fine-tuning. For more information see the SCOOT user guide (Reference 1.3.2(e)).

9.2.7 SCOOT Parameter Display

This display allows the values, counters and flags within the SCOOT Sub-System to be examined on a second by second basis. For each level of SCOOT object (region, node, link, stage, detector) a display is produced showing the value of those parameters affecting the SCOOT model at that level.

The displays are used to verify and investigate the current mode of operation within the SCOOT model allowing a large number of parameters to be displayed simultaneously. Within the limitations of the screen display several SCOOT objects and levels can be displayed together.

The display is intended for use by STC in diagnosing data and System problems.

9.2.8 System Data Display

This display shows the equivalent FMS data entry screen with the current data values without the necessity of starting the data preparation process.

9.2.9 Daily Flow Display

This facility allows the operator to view count information obtained for a specific date.

9.2.10 Weekly Flow Display

This facility displays count information in hourly steps for a whole week.

9.3 Colour Graphic Displays (Non Windows)

9.3.1 Introduction

The System provides a number of colour graphic displays for use on PC Workstations; a user definable picture system, the SCOOT VEGA diagram and a Time and Distance Diagram. In addition all the displays described in section 9.2 are also available on the PC Workstation.

9.3.2 User definable pictures

The user definable picture system allows the operator to create a diagrammatic display of System operation. The contents of the display can be created using

basic characters such line, arrows, rectangles etc. and pre-defined fields to show data on particular types of equipment. Each display consists of static fields, i.e. text, straight lines, arrows etc., and also includes dynamic fields that are continually updated by the System when the display is in use.

9.3.3 VEGA diagram

The SCOOT VEGA diagram shows the arrivals and queue profile for a particular link to be displayed in two graphs. The top graph represents the arrivals at the stop line with the colour indicating the state of lights for the link whilst the bottom graph represents the start and end of queue positions. The System allows 4 such displays to be output simultaneously on one screen and the links can be individually specified to enable the user to examine the co-ordination through a route.

9.3.4 Time and Distance diagram

The Time and Distance Diagram allows the period during which nominated stages on a number of controllers are green to be displayed in a graph. Time on the 'X' axis and distance on the 'Y' axis. The addition of markers showing a selected cruise speed allows some appreciation of the on line control to be achieved. The facility can also be used to predict the effect of green waves and is useful for checking the timings.

9.4 Graphical User Interface (GUI) Displays

Note: licensed facility - see section 2.3.

9.4.1 Introduction

These displays provide a System interface via Windows, menus and a mouse, and permit multiple windows to be shown simultaneously. The facilities available combine the majority of those of the monochrome and colour displays.

9.4.2 Iconising of Windows

All windows displayed on the GUI screen can be minimised to a small icon to reduce the amount of information being shown on the screen at any time. The icons can be double-clicked using the mouse button, which restores the window to its previous size and position on the screen. Any information sent to the window whilst iconised is not lost as these are constantly updated in the same manner.

9.4.3 UTC Window

This is a character input/output window, which is opened on selecting the UTC Window option or one of the monochrome commands described in section 9.2. On selecting the window or command the text window is opened.

9.4.4 Colour displays

Alternative colour displays of the colour displays described in section 9.3 can be shown.

(1) User definable pictures

User definable pictures are made up from two basic elements: the map, showing the physical layout of streets etc., and the graphics for displaying traffic movements, equipment status, etc. The Map Editor can import DXF format files, as produced by the AutoCAD program, plus NTF2 files. It also permits the addition and modification of features. The Graphics Editor adds, modifies and deletes drawing and live-update symbols. The saved pictures can be displayed, showing live-update displays equivalent to those in section.

(2) VEGA diagrams

The VEGA diagrams are equivalent to those described in section 9.3, except that the number of screens that can be displayed is limited only by the workstation's capacity and additional facilities are available for resizing the window, the display of either one or two cycles and colour modifications.

(3) Time and Distance Diagrams

The Time and Distance Diagrams are equivalent to those described in section 9.3.4 except that additional facilities permit the resizing of the screen and the display of cruise speed has more options available.

(4) Count Detector Displays

Note: licensed facility - see section 2.3.

This displays count detector data in a histogram form for count or occupancy values for detectors controlled by a single TCC. Each display can show single or multiple detectors. For counts each value displayed is the sum of all the individual detectors counts, and for occupancy each displayed value is the average occupancy for all the detectors. One use of this facility would be to display the total number of vehicles entering or leaving the city by measuring the total counts at incoming or outgoing detectors.

Both displays can be configured to show data in intervals of 5, 15, 30 and 60 minutes, ranging from the previous 1 to 24 hours.

The count display can be configured for maximum and expected flows. When the flow exceeds the expected flow during one interval the histogram for the interval is displayed in red.

The occupancy display can be configured for up and down thresholds. When the occupancy exceeds the up threshold during one interval the histogram for the interval is displayed in red. When the occupancy falls below the down threshold during a subsequent interval the histogram for the interval is displayed in green.

9.5 Screen Dumps to Printer

The screen dump facility may be divided into two separate sections, firstly an ability to dump a screen to a printer connected directly to a PC Workstation, and secondly the ability to print copies of displays on a System printer.

The UTC System is also capable of printing a monochrome copy of displays generated on terminals. The copy is printed on a device nominated during data preparation.

9.6 Listings

The System provides a number of ways of listing data, including: the unacknowledged alarms, the current faults, equipment on a green wave route, active event messages, picture files, current equipment status, equipment data values, Fixed time plan timings produced from averaged SCOOT timings, etc.

9.7 Log OTU Replies to Disc

The Log OTU Replies to Disc facility provides a means of recording the control and reply data sent to and received from a specified OTU over a given period of time. Data is only recorded if it has changed in the last second and once recorded is available to be printed out later.

Logging is started and stopped by command, which includes the identity of the OTU and either an end time within the next 24 hours or a parameter to specify that logging should be continuous. If this time is omitted, the logging finishes after a user configurable period.. The identity of the OTU can be specified using either its SCN or its address.

Once logging for an OTU is complete a command is available to format and spool the data to the printer associated with the terminal at which the print command was entered; alternatively the output may be sent to the EXPORT directory. A date and time range can be specified to exclude unwanted data - only the data recorded within the given times on the specified day is output.

The files are automatically deleted after a user configurable number of days have expired.

9.8 Event Driven Messages

Note: licensed facility - see section 2.3.

The System can provide, on demand, the event driven messages, defined in the SCOOT User Guide (reference 1.3.2(e)), from either the operator or the timetable.

Each message relates to a specific SCOOT SCN, and whenever the SCOOT sub-System generates the data for the message it is output to the initiating terminal, the terminal specified in the command line or stored to a file on the system disk.

It is possible to list the active messages at any time by operator command.

9.9 User Information Messages

This facility allows the user to:

- (1) Input a text message at a user terminal for transmission to another user terminal or to all terminals. Such messages can also be stored in a time table or in a CAST.
- (2) Associate a single text message with a UTC equipment SCN. For junction and pelican equipments this text appears in the fault messages part of the plan monitor display. For these, and other UTC equipments the message is included in appropriate fault listings. The contents of a text message can also be displayed in a map window.

- (3) Set up (S) and view a noticeboard which contains free text messages. Such a noticeboard may be configured to be automatically shown whenever a user logs in using the graphical user interface.

10. DATA FILE MANAGEMENT

10.1 Off line Data File Storage

Apart from the normal facilities for backing up discs using normal operating system features, the data files produced by the System are "archived" on a daily basis. These archived files are stored on the TMC. During data preparation the number of days is specified for which these files are held. After this time period has elapsed the files are deleted. If the TMC is unavailable when the archive occurs then the files are retained on the TCC(s) for a configurable number of days and are archived when the TMC becomes available. During the "archive" period these files may be copied onto alternative storage devices using procedures described in the System Management Guide (reference 1.3.2(f)). The files available for archiving are those produced by the System Log, controller checks, OTU Control/Reply word logging and Count detector sub-systems; at the same time the user configured data is also copied. The System also provides a facility for copying the count detector data to PC workstations, see section 8.3.

10.2 Data Transfer to a PC

System data can be transferred to a suitable PC workstation equipped with a hard disk for subsequent analysis. This data consists of the following:

- (a) Daily System log files;
- (b) logged OTU files;
- (c) 5-minute detector count and occupancy values;
- (d) Weekly detector counts;
- (e) Car park counts and occupancy.

The transfer may be implemented by operator, timetable and CAST commands.

A conversion program on the PC allows the count and occupancy values to be transformed into the standard dBase format, which can be analysed to create reports and graphical outputs with the appropriate user's software. This facility is available under a separate licence from STC.

10.3 Shareable Data Directory

The shareable directory/folder "EXPORT" is set up on the Traffic Management Computer (TMC) to allow an alternative destination to the PC for data transfer.

The shareable directory may be accessed from a PC that is networked to the TMC.

Files placed in this directory are automatically deleted after one month.

To TXDF a weekly count file to the Export directory the following command could be used:

```
TXDF CO 5-AUG-00 >EXPORT
```

The file is then placed in the Export directory. The file name is the date and time of its creation in the form expor_{tyyyymmddhmmss}.txt.

Thus, a file created at 11 hours 32 minutes and 27 seconds on 30th August 2000 has the name

EXPORT20000830113227.TXT

The directory is set up as a pseudo printer in TUAC so that files may be sent to it. The pseudo printer does not function as a log printer. The set up details are as follows:

Item	Value	Comment
SCN	T99010	To be chosen by the user
Description	Export	
Physical Name	\$EXPORT	Must be \$EXPORT
Baud Rate	9600	Not important
Language	English	
Type	HARDCOPY	Must be Hardcopy
Form_Length	66	Not important
UTC_Output	NO	Must be set to NO
SCOOT_OUTPUT	NO	Must be set to NO
NARROW_PAPER	NO	Must be set to NO
INHIBIT_INQUIRE	NO	Must be set to NO
LOG_PRINTER	NO	Must be set to NO
FAULT_PRINTER	NO	Must be set to NO

Files may be copied from the Export directory using "drag and drop". To access the Export directory, users running TCP/IP for communications between the PC and the TMC should click on the Windows Start button and select Run. If the TMC is, say, UTC20 the following should be typed into the Run box

```
\\UTC20\EXPORT\
```

If Pathworks is used for communications between the PC and TMC, the following command should be typed at a DOS prompt on the PC

```
USE G: \\UTC20\EXPORT\
```

where G: is an unallocated disk drive letter.

File Manager can then be used to access the contents of the G: directory.

Before this facility can be used a print queue must be set up; the Systems Engineer performing the software update should do this. If it has not been done, please ask the UTC Support Desk for this to be done.

10.3.1 OTU Log Files in ASCII Format

The creation of the Export directory means that OTU data can now be logged in an ASCII format file.

This is achieved by re-directing the output of the DLOT command to the Export pseudo printer. An example command is:

```
DLOT X03110 >EXPORT
```

11. UTC SYSTEM WITH NETWORKED COMPUTERS

11.1 Traffic Management Computer

The Traffic Management Computer (TMC) is used for data preparation, data archiving etc. It does not have the ability to directly control traffic but interfaces through the Traffic Control Computer(s).

11.2 Traffic Control Computers

The Traffic Control Computer(s) (TCC) controls the on-street equipment through the Data Transmission System. Each computer typically contains a number of sub-areas, each sub-area being completely contained within one computer; SCOOT regions are also completely contained within one computer.

The computers are referred to as TCCA through to TCCH.

11.3 Combined Management and Control Computer

For Systems that require only one TCC, or for which a separate management computer is not required the role of TMC may be combined with the first TCC, TCCA.

11.4 Connectivity

Commonly the UTC System makes use of Ethernet or a high speed serial interface. The hardware configuration depends upon the nature of the computer network topology and inter-computer distances. The hardware configuration for a particular System is defined in the Customer Requirement Specification (reference 1.3.2(b)) for that System.

The failure of one of the TCCs does not affect the other TCCs' ability to control the on-street equipment. If the TMC fails some loss of functionality will result.

12. UTMC COMMON DATA BASE

12.1 Introduction

The UTC System may be linked to different UTMC Common Data Base Systems, e.g. STC COMET, whose data base objects are defined in reference 1.3.2(n).

13. USER ACCESS THROUGH A TERMINAL SERVER

13.1 Terminal Interface

Terminal equipment (including dial-in terminals) can be connected to the UTC System by a number of means, directly through serial interface cards plugged into a UTC computer, through a dial-in System or through terminal servers (see section 14.2.10) connected to the inter-computer Ethernet link.

13.2 The User Interface

This section only applies to terminals connected to the System by a terminal server.

Before using a terminal server it is necessary to tell the server which computer you want to connect to. This is achieved by a short sequence such as "C TCCA", where "C" is short for "connect" and "TCCA" is the computer identifier.

When the terminal server connects to the computer the UTC System responds with a request for user identity and password before access is granted, see section 5.4 for more details.

13.3 The Terminal Configuration Process

This section only applies to terminal servers.

Terminal servers supplied with a UTC System come pre-configured by STC for use with the System. In the event of a fault occurring in the terminal server that requires a replacement to be used then this needs to be reconfigured.

14. HARDWARE

14.1 Introduction

This section is concerned with the hardware normally associated with a UTC System. It is divided into two sections, instation and outstation equipment.

14.2 Instation Equipment

14.2.1 Introduction

This section describes the equipment normally located at the UTC instation. Some of the facilities described, such as the wall map, are optional and may not be present in every System.

14.2.2 Traffic Computer

The UTC System is based on a PC platform. The computer is equipped with a hard disk of suitable capacity, a means of backing the disk up (normally magnetic tape) and a number of serial ports.

14.2.3 System Modem

The System modem is used to allow dial-up access to the UTC System using a password protected security system, section 5.4. The modem is a standard device using the Hayes protocol and having an "inactivity" timer.

14.2.4 Hard Copy Printer

The printers for the System can be either monochrome or colour. The System supports the following types of printer:

- (1) Monochrome printers originally supplied by the Digital Equipment Corporation.
- (2) ASCII text printers.
- (3) Post Script level 3 colour printers such as the HP Deskjet 895cxi. It is recommended that these printers should be connected to a PC that is networked to the UTC System.

It is recommended that at least one printer is used.

14.2.5 PC Workstation (GUI)

The GUI PC Workstations use a Windows X-terminal emulator interface to provide the monochrome and colour graphic displays described in section 9.4. Traffic count and other data may be copied from the UTC System to a GUI PC workstation by using the TXDF command.

14.2.6 System Indication Panel

The System Indication Panel, or SIP, contains audible and visual indications of faults occurring on the System. In addition, it provides a visual indication that the

System is operating normally through the watchdog lamp. The actual design of the SIP is described in the Customer Requirement Specification (reference 1.3.2(b)).

14.2.7 Wall Map

The wall map is an optional facility on the System. It can vary from a mosaic tile with no status indicators, through a map on a Perspex sheet with indicators, to a mosaic tile with indicators. The status indicators can be used to indicate amongst many options equipment faults, operator control and main road in operation. Details of the way (if any) the System drives any indicators on the wall map is given in the Customer Requirement Specification (reference 1.3.2(b)).

14.2.8 Data Transmission Equipment

The data transmission equipment at the instation is used to communicate with the on-street equipment on a one-second cycle. It detects and reports the failure of any OTU. It uses equipment specially developed by STC for this application. The equipment has both BAPT and DoT approval for use in the UK.

14.2.9 UTC System Cubicle(s)

The System cubicles normally contain the fixed items of the UTC System, the Telecommand 12 PC, a SIP and data transmission equipment. A second, "slave", SIP may be located in the control room, away from the cubicle.

14.2.10 Terminal Server

A terminal server is a piece of equipment that allows terminals to be connected to the System without them being physically plugged into the computer itself. In a multi-computer System this allows users to select the computer to which their terminal is connected, so that if one computer fails the terminals can continue to be used.

14.2.11 Roving Terminal

The Roving Terminal facility provides a portable package giving a terminal capable of connecting to the System through a radio system. It is intended for use on street whilst validating the SCOOT model²¹. It is ruggedly constructed and self-powered. It consists of a metal case containing a small terminal, modem, radio and batteries.

Connection of the Terminal to the System makes use of the dial-up access system described in section 5.4.

In the UK the unit is implemented using a modem that provides communications over a Cellular Radio Network using the Cellular Data Link Control (CDLC)

²¹ Traditionally SCOOT validation has been done using normal radio communications. This involves having an operator permanently allocated to this task at the instation and this method takes on average 1.5 days per node. Using a roving terminal eliminates the need for the operator and shortens the validation period to typically one day per node. Overall a saving of 2 man-days per node.

forward error correcting protocol. The Cellular Radio companies provide facilities to change from the CDLC protocol to protocols suitable for use over the PSTN network.

14.3 Outstation Equipment

14.3.1 Introduction

This section describes the equipment located in the equipment cabinets on the street. Some of the facilities described, such as the Green Wave Route Selection Box, are optional and may not be present on every System.

14.3.2 Outstation Data Transmission Equipment

The Telecommand 12 outstation data transmission equipment is contained within a rack that may be either 19 or 11 inches wide. Each version contains an integral detector rack that is powered from the OTU. This is the normal way in which SCOOT detectors are linked to the System.

Equipment is interfaced to the OTU using reed relays, with an open contact being seen by the System as '0' and a closed contact as '1'. The one exception to this is that for SCOOT loops only a vehicle present is an open contact, the OTU then inverts the bit. This is a fail-safe feature.

If a particular situation requires the use of uni-directional loops then the OTU contains the logic to process up to four such loop pairs.

14.3.3 Traffic Controllers

The UTC System is designed to interface with street equipment using the United Kingdom DoT specifications MCE 106 and MCE 0141 for stage control and reply bit format. Any controllers that comply with this standard and have a suitable hardware interface can be controlled by the System. Similarly, Pedestrian Controllers are interfaced using the United Kingdom Hold Green Vehicle Phase bit.

14.3.4 Signs

The sign interface is normally contacts open when no control is applied, this being the default state. With closed contacts the UTC System considers that it is driving a '1' to the sign. Reply information is as described in section 14.3.2 above.

14.3.5 Traffic Detectors

Depending on the detector count bit format used for a detector, either one or two bits are used for counts, one for faults, and an optional bit for occupancy. Each change in state of the least significant bit represents 'n' vehicles. The value 'n' is configurable in the range 1 to 9.

14.3.6 Green Wave Route Selection Boxes

These boxes are designed to allow firemen to select their route as they leave the fire station. The unit then communicates with the UTC System and triggers the selected green wave, see section 7.6.

The box comprises an OTU and switches mounted in a suitable enclosure. The standard unit has 6 route selection buttons. As the firemen leave the fire station the button associated with their selected route is pressed. At this point the unit sends a route initiation signal to the UTC System; this signal is held for 3 seconds. Having accepted the green wave route request the UTC System lights the appropriate route confirmation lamp that remains lit whilst the route is running.

The unit comes either in one unit containing the panel and OTU or as two parts, one for the OTU and the other for the panel. In this case the panel can be made water and dust resistant for use in a Fire Station.

15. SOFTWARE

15.1 Introduction

The software provided with the UTC system comprises STC software and other software supplied by other manufacturers and public domain software.

15.2 STC Supplied Software

The STC developed software provides the standard UTC facilities described in this document.

15.3 Computer Manufacturers' Software

The software on the UTC servers is:

- (1) Windows Server
- (2) ACRONIS back-up

The software on the PC workstations is:

- (3) Hummingbird Exceed

16. SYSTEM INTERFACES

16.1 Introduction

There are two main interfaces on the UTC system, the first being to the street equipment, the second the operator terminals, printers and (optionally) a wall map. A number of interfaces to external systems can be supplied with the system, which are detailed below.

16.2 Street Equipment Interface

The UTC system communicates with the on-street traffic control and monitoring equipment through the STC data transmission system.

The Roving Terminal communicates with the UTC system via a modem. The operation of the Roving Terminal is identical to a textual operator terminal.

16.3 Operator Interface

Operator commands are entered via one or more UTC terminals, which can be one of the following:

- (1) Roving Terminal running its own software or the CTERM communication software - text only
- (2) Graphical User Interface (GUI) operator terminal, with a multiple windows environment (this requires the appropriate licence - see section 9.4).

16.4 STC Remote Monitoring System (RMS) Link

Note: licensed facility - see section 2.3.

The RMS system automatically dials up to remote equipment at pre-defined intervals, logs detected faults and provides management functions for fault reporting and equipment maintenance. The UTC and RMS systems can communicate with each other to pass fault information both ways.

The RMS system can also pass count detector flow and occupancy information to the UTC system. On the UTC system this data can be displayed and stored identically to directly connected count detectors.

The UTC System monitors the RMS link and reports the failure and re-establishment of the link.

16.5 Motorway Control System Link

Note: licensed facility - see section 2.3.

The Motorway Control System is known as NMCS.

A two-way communication link between the UTC and NMCS system permits the following:

16.5.1 UTC to NMCS interface

Motorway plan numbers are transmitted to the NMCS system by the use of operator or timetable CASTs. Each action, together with an associated text message, is stored in the system log.

16.5.2 NMCS to UTC interface

CASTs received from the NMCS system are actioned by the UTC system by setting VMS and lane control signs. The NMCS system sends sign state information to the UTC system for storing in the system log and updating any suitably configured display in the Map window.

16.6 Environmental Monitoring Interface

Note: licensed facility - see section 2.3.

Analogue data measured from environmental sensors is passed to the System via an enhanced TC12 OTU. The system correlates the quantities of gas pollutants and other atmospheric conditions with traffic conditions, and may implement appropriately configured control strategies to counter the effects of adverse conditions.

16.7 Foreign Language Interface

Note: licensed facility - see section 2.3.

This facility permits the configuration of a System with from 1 to 5 different languages (one of them being English). Each user is configured with his own language, and when he logs on to the System the user interface, including all messages he receives, are in his defined language. A default language for the System is configurable, which is used for storing the system log. When a user not configured with the default language requests the system log to be output on his terminal, the log is output in the default language plus an additional line containing the fixed message text part of the message (e.g. [Invalid stage transition]) in his own language.

16.8 ITMC System Interface

The System can be interfaced to an ITMC system. Facilities available at present include:

- Transfer and receipt of data between the two systems
- Variable Message Sign settings (see section 16.18)
- ASTRID (see section 16.9)
- On-street Parking (see section 16.10)

16.9 ASTRID Interface

Note: licensed facility - see section 2.3.

The UTC system can provide an interface such that event driven messages and car park information can be transferred for further processing and calculation by ASTRID.

16.10 On-street Parking Interface

Note: licensed facility - see section 2.3.

The UTC System is able to interface to an on-street parking PC that collects data from Pay-and-Display machines with data on current ticket validity. An additional car park type can be configured with a number of ticket machines. Commands used for other car park types, such as setting states, capacities and thresholds can be used with the on-street car parks.

16.11 Upload / Download of Controller Data

Note: licensed facility - see section 2.3.

The Upload / Download facility allows the transfer of controller and OTU data between the street equipment and central office control computer via the TC12 data transmission system.

The upload / download facility has three modes of operation. The modes available on a UTC System are configurable by STC and consist of up to three of the modes described below.

(1) Split Second Mode

In this mode there is no effect on the control and reply data. The controller continues to operate normally and the upload/download process is transparent. The System uses part of the one-second time frame to transmit and receive upload/download data with the controller. In this mode less equipment can be located on a telephone line than when using either of the other modes.

(2) Continuous Mode

The System continuously transmits and receives upload/download data with the controller. In this mode normal UTC control is suspended to all controllers on the same line as the controller currently being updated during upload/download.

When an operation requiring upload/download is required using the "Continuous Mode" of operation a warning dialogue is displayed on the UPDL Workstation. This lists the controllers that are off-line during the use of UPDL. Before UPDL can commence, this dialogue must be confirmed by operator action.

(3) One-Second-in-N Mode

The System uses one second in every N seconds to transmit and receive upload/download data with the controller. The value of N is user configurable between 4 and 30 seconds.

There is no noticeable effect on normal UTC stage control and stage reply data using this mode.

16.12 External Time Source

Note: licensed facility - see section 2.3.

The System is able to monitor both the UTC system time and the external system time (e.g. GPS or Wharton clock). If a difference greater than the configured tolerance occurs then the TMC time is updated with the external time source time, and this in turn updates the TCC times.

16.13 Time Display Clock Interface

A serial interface is provided to drive a clock to display UTC system time.

16.14 Transfer of Link Travel Times to PC

Taking information from the SCOOT model, each TCC can send the calculated link travel times to a defined PC every five minutes. This PC runs WFTP (shareware) under the TCP/IP network protocol.

16.15 SIESPACE Car Parking System Interface

The system can interface with Siemens SIESPACE Car Parking Systems via a LAN and/or serial link using TCP/IP.

The information transmitted to SIESPACE is:

- (a) Car Park occupancy data
- (b) System time
- (c) Fault status request
- (d) Sign status.

The information received from SIESPACE is:

- (a) Sign setting state messages
- (b) SIESPACE system fault data.

16.16 Travel Terminal Interface

The UTC System can provide an interface with the Travel Terminal to receive travel information from the Police, Rail Companies and others.

The system receives incident data from the Travel Terminal, including public transport abnormalities. This is stored in the RDBMS with other incident records.

Travel Terminal messages received are integrated into the System Log.

16.17 ALFIA Systems Car Parking Interface

The UTC System can provide an interface, via the OTU handset port, to an Alfia Systems Ltd car parking system.

The number of available spaces for up to 23 car parks are sent one per second in a continuous cycle. A fault is raised if an update has not been received after three minutes.

16.18 Car Park Variable Message Sign System

Note: licensed facility - see section 2.3.

Variable Message Signs, managed by a dedicated PC, can interface to the UTC system. The system supports a combination of communication methods, of which radio-based X-25 and Paknet are currently supported. The sign types supported are:

- Car Park signs to display the number of spaces available in specific car parks or car park groups.
- Urban signs displaying user-configurable information
- Mobile VMS signs that are linked via a radio interface and display user-configurable information.

16.19 Web Server Interface

Note: licensed facility - see section 2.3.

The System can export UTC map pictures to a web server. The frequency of map picture updates will depend upon a number of factors, which include, the size of map, the power on the TMC computer, the speed of the network link to the web server, etc.

16.20 Link to STC Fault Management System PREFECT

The link between a UTC System and a Prefect Fault Management system may be one of two types:

- (1) A serial connection between the UTC TMC and the Prefect PC. The UTC System treats the Prefect PC as a printer and outputs all messages to it. Prefect then filters out those messages which it does not use.
- (2) An Ethernet link which copies the output messages to a file in a shared folder on the Prefect PC, using TCP/IP and Samba. The message files are copied every 2 minutes or after 30 seconds of no new messages being added to the message file.

16.21 Link to Other Host Computers

The System can send data from the UTC System to any other host computer which is linked by Ethernet to the UTC TMC. This link behaves as if it is a printer and can transmit those types of data which may be output to a printer. An example of such data is a SCOOT event driven message. The receiving host computer is responsible for the processing of the transferred data. The customer should ensure that the network link and receiving host computer are of sufficient capacity to handle the transferred data. STC should be involved in the setting up of any such link.

Appendix A - Summary of System Commands

This is a table of all the commands available in the UTC System. Against each command there are a number of parameters, which are:

- L - the default command level required to action it
- O - operator command
- T - timetable command
- G - command is logged
- A - actioned in real time. A command of this type, when occurring in a timetable, is only actioned at the defined time. If the system is restarted and the timetable scanned, these commands are not actioned if this time has passed.
- C - can be used in a CAST
- J - command is journalled

Name	Function	Type						
		L	O	T	G	A	C	J
ACAS	Action CAST	8	O	T	G			
ACCT	Action CAST by region cycle time	13	O	T	G		C	
ACKD	Acknowledge fault(s) and cancel alarm	2	O		G			
ACSV	Action CASTs by Sensor Values	8	O	T	G		C	
ALRM	Output alarm text message	10	O	T			C	
ARCM	Start removable Disk Archive	14	O		G			
ARRQ	Associate remote request with CASTs	13	O	T	G		C	
ASLD	Assign SCOOT link to count detector	12	O					
ASTD	Start up the ASTRID display	14	O					
ASTR	Action a selected strategy	8	O	T	G		C	
AUDI	Enable audible alarms	8	O	T	G		C	J
AUTH	Change SCOOT Authorities	13	O		G			
AVSP	Average SCOOT Plans	4	O	T	G	A	C	
CANA	Silence audible alarms	1	O		G			
CARP	Change Car Park status	12	O	T	G		C	J
CDBC	Select SCNs to be sent to Common Data Base	14	O					
CHAN	Change value of parameter	8	O	T	G		C	J
CHCK	Start controller test sequence checking	12	O	T	G	A	C	
CHCP	Change pelican controller checks mode	16		T	G		C	J
CHDC	Initiate SCOOT detector counts checking	16		T		A	C	

CHGO	Changeover to standby computer	16	O	T		A	C
CHSI	Check and exercise signs	12	O	T	G	A	C
CJNL	Insert clear journal command into the journal	14	O	T	G	A	C J
CLOS	Close car park	10	O	T	G		C J
CPOC	Output one day's Car Park occupancy	4	O	T		A	C
CPOP	Display car park occupancy	4	O	T		A	C
CSFY	Call special facility	12	O	T	G		C J
CSUM	Associate count detectors with summing pseudo detector	12	O		G		
DATE	Modify current date	14	O		G		
DBAS	Run data preparation process	14	O		G		
DCAS	Delete an entry from a CAST	12	O		G		
DCOF	Delete car park occupancy file	14	O		G		
DCOU	List output of SCOOT detector checks	4	O	T		A	C
DDFV	Display Default Values	4	O	T		A	C
DEMA	Force demand on a particular stage	12	O	T	G		C J
DGUL	Display SCOOT GULP data	4	O				
DIAL	Allow dial-up terminal access	14	O	T	G		C J
DIMO	Transmit dimming override bit	10	O	T	G		C J
DIPM	Display plan monitor	4	O				
DISO	Disconnect outstation	10	O	T	G		C J
DLOT	Display logged OTU data	4	O				
DSSG	Display logged stage timings	1	O	T		A	C
DUBA	Difference Against User Baseline	4	O	T		A	C
ECAS	Edit CAST	14	O		G		
ECHO	Echo message to terminal	6	O	T		A	C
EDAV	Earliest date of system files available	4	O				
EMES	Equipment Message	6	O	T	G	A	C
EMIX	Specify mix of engine types for pollution modelling	8	O	T			C J
ENDS	Terminate session	1	O				
ENOT	Edit noticeboard contents	10	O				
FALL	Transmit fall-back mode bit	10	O	T	G		C J
FLAS	Set controller to flashing amber mode	2	O	T	G		C J
FLOW	Display detector flow monitor	4	O				
FLTA	Specify which faults should raise a system alarm	12	O	T			C J

FLTG	Create or modify a fault group	6	O		G			
FLTY	Set fault manually	12	O	T	G	A	C	
GDDD	Graphical data display	1	O					
GENP	Generate semi-graphic pictures	6	O					
GUBA	Restore recorded baseline values	10	O	T	G		C	J
GWAV	Start operator green wave	12	O		G			
HELP	Online HELP screen	1	O					
HRYC	Start manual hurry call	12	O	T	G	A	C	
ICAS	Insert an entry into a CAST	12	O		G			
IFLT	Inhibit faults by category on an equipment	10	O	T	G		C	J
IHPC	Inhibit plan compliance fault isolation	12	O	T	G		C	J
IHRW	Inhibit reply word analysis	12	O	T	G		C	J
IHTP	Inhibit tram priority	12	O	T	G		C	J
INFO	Display information for an outstation	4	O					
INHW	Inhibit weekly flow analysis	10	O	T			C	
INTD	Introduce diversion	10	O	T	G		C	J
ISOL	Isolate controller	10	O	T	G		C	J
KILL	Shutdown System	12	O		G			
LACC	List CAST associations	4	O	T		A	C	
LACS	List configured ACSV commands	4	O	T		A	C	
LARR	List Associated Remote Requests	4	O	T		A	C	
LCAS	List the contents of a CAST	4	O	T		A	C	
LCOF	List car park occupancy files	4	O		G			
LFLG	List currently defined fault groups	4	O	T		A	C	
LFTA	List faults which raise system alarms	4	O	T		A	C	
LIFT	List categories of faults that have been inhibited	4	O	T		A	C	
LIHR	List equipments with reply word analysis inhibited	4	O	T		A	C	
LIHS	List controller history	4	O	T		A	C	
LIPT	List plan timings	4	O	T		A	C	
LIVE	Stop simulation of an equipment	12	O		G			
LJNL	List operator journal	4	O	T		A	C	
LLCF	List link conversion factors	4	O	T		A	C	
LLNK	Transmit local link inhibit bit	10	O	T	G		C	J
LMON	SCOOT link monitor	4	O					
LNMC	List networked message commands	4	O	T		A	C	

LOGM	List Event Message Log	4	O	T	A	C
LOGO	List message log	4	O	T	A	C
LOTU	Log OTU control and reply bits	8	O	T	A	C
LSCH	List all the priority CHANs in effect	4	O	T	A	C
LSTA	List unacknowledged alarms	4	O	T	A	C
LSTD	List flow detector status	4	O	T	A	C
LSTF	List faults	4	O	T	A	C
LSTG	List green wave routes	4	O	T	A	C
LSTM	List active event driven messages	4	O	T	A	C
LSTP	List picture titles	4	O	T	A	C
LSTS	List status	4	O	T	A	C
LTEC	List transmission error counts	4	O	T	A	C
LTRA	List current tram priority for a junction	4	O	T	A	C
LUBA	List user baseline	4	O	T	A	C
LVAL	Link validation display	10	O			
MESS	Commence output of event message	6	O	T	G	C J
MONI	Display outstation monitor	4	O			
MOVA	Set MOVA priority control	10	O	T	G	C J
MOVE	Move type 8 (moveable) count detector	14	O	T	G	C J
MWAV	Start manual wave display	12	O		G	
NCAS	Name a CAST	12	O		G	
NFTD	Node fine tuning display	8	O			
NMCS	Send command numbers to remote non-UTC computer	8	O	T		A C
NODT	Transfer a SCOOT node from one region to another	12	O	T	G	C J
NOTB	Display noticeboard contents	1	O	T		A C
OFST	Change Stage Offsets	12	O		G	
OJNL	Optimise the journal	12	O		G	
OPEN	Open car park	10	O	T	G	C J
OPFD	Output flow detector data	4	O	T		A C
OUTT	List contents of timetable	4	O			
OVRB	Override control/reply bits	15	O		G	
PICT	Display selected picture	4	O			
PLAN	Select fixed-time plan	8	O	T	G	C J
PPRP	Prepare plan data	14	O			
PRIN	Enable log printer	10	O	T	G	C J

PVAL	Print LVAL log	4	O	G			
RCOF	Record car park occupancy file	14	O	G			
REIN	Reinitialise SCOOT databases	14	O	T	G	A	C J
REMD	Remove diversion	10	O	T	G		C J
RFTD	Region fine tuning display	8	O				
RRUL	Select Raid rules file	10	O	T	G		C J
RSTA	Shut down and restart UTC computer	16	O		G		
RUBA	Record user baseline	10	O		G		
SAPS	Start automatic plan selection	10	O	T	G		C J
SCAS	Action the CHANs in a CAST in priority mode	8	O		G		
SCOO	Implement SCOOT control	8	O	T	G		C J
SEED	Look at database values	4	O				
SFNO	Inhibit special facility selection	12	O	T	G		C J
SIGN	Override sign legend	12	O	T	G		C J
SIGO	Change Car Park sign group search order	12	O	T	G		C J
SLOF	Turn part time signals off	12	O	T	G		C J
SNSD	Display current analogue sensor value	4	O				
SNSS	Display analogue sensor value	4	O				
SNSV	Display current sensor value	4	O	T		A	C
SORT	Sort controller checks messages	8	O	T		A	C
SSGM	Log stage timings to data file	1	O	T	G	A	C
SSPC	Send message to SIESPACE Car Park PC	12	O	T		A	C
SSSU	Start SCOOT survey	10	O	T			
STCS	List car park/sign status	4	O	T		A	C
SURV	Display survey flow counts	4	O				
SUTT	Supersede timetable	14	O		G		
SYNC	Synchronise group timers	8	O	T	G	A	C
TAPS	Start APS in test mode	10	O	T	G		C J
TDDD	Time distance diagram display	6	O				
TEST	Test wallmap or SIP	8	O		G		
TIDL	Start tidal flow control	1	O	T	G	A	C
TIME	Modify current time	14	O		G		
TRAP	Set tram priority	12	O	T	G		C J
TROF	Disable output of unsolicited messages to a terminal	8	O	T	G		C J
TSYN	Implement immediate time synchronisation	14	O	T	G	A	C

TTBP	Start timetable preparation	14	O	G		
TUAC	Terminal and user account configuration	16	O	G		
TUNL	Change tunnel lane flow direction	1	O	T	A	C
TXDF	Transfer file to PC work-station	12	O	T	A	C
UCOF	Use car park occupancy file	14	O	T	G	C J
UDDL	Upload/download - download data	14	O	T	G	A C
UDFV	Upload/download view fault log	4	O			
UDLC	Check and update TC12 OTU data transmission parameters	14	O	T	A	C
UDMC	Upload/download configure line mode of operation	14	O	T	G	C J
UDRH	Upload/download remote handset	14	O	G		
UDSL	Upload/download status listing	4	O	T	A	C
UDUL	Upload/download - upload data	14	O	T	G	A C
UPDA	Introduce updated data	14	O	G		
VALU	Display value of parameter	4	O	T	A	C
VARY	Vary stage green times	12	O	G		
VEGA	Display SCOOT link profiles and queues	4	O			
WAVC	List weighted averages table	4	O			
WEEK	Display weekly detector flow counts	4	O			
WHAT	List equipment	4	O			
XACC	Delete CAST association with cycle time	13	O	T	G	C
XACS	Cancel ACSV command	8	O	T		C
XAPS	Cancel APS	12	O	T	G	C J
XARR	Disassociate remote request and CASTs	13	O	T		C
XAUD	Disable audible alarms	8	O	T	G	C J
XCAR	Cancel car park state control	12	O	T	G	C J
XCHA	Cancel a priority CHAN command	8	O			
XCHC	Stop controller test sequence checking	12	O	T	G	A C
XCHG	Restore normal TCC operation	16	O	T	A	C
XCHS	Stop sign exercising	12	O	T	G	A C
XCSF	De-select special facility	12	O	T	G	C J
XDEM	Cancel forced demand(s) on a particular stage	12	O	T	G	C J
XDIA	Disable dial up access	14	O	T	G	C J
XDIM	Clear dimming override bit	10	O	T	G	C J
XDIS	Re-connect outstation	10	O	T	G	C J

XEME	Clear equipment message	6	O	T	G	A	C
XFAL	Clear fall-back mode bit	10	O	T	G		C J
XFLA	Cancel flashing amber mode	2	O	T	G		C J
XFLG	Delete a fault group	6	O		G		
XFLT	Clear fault	8	O	T	G	A	C
XFTA	Specify faults which should not raise system alarms	12	O	T			C J
XGWA	Cancel operator green wave	12	O		G		
XHRY	Cancel manual hurry call	12	O	T	G	A	C
XIFT	Cancel inhibition of fault categories on equipments	10	O	T	G		C J
XIHP	Re-enable plan compliance fault isolation	12	O	T	G		C J
XIHR	Re-enable reply word analysis	12	O	T	G		C J
XIHT	Cancel inhibition of tram priority	12	O	T	G		C J
XINH	Cancel inhibition of weekly flow analysis	10	O	T			C
XISO	Cancel controller isolation	10	O	T	G		C J
XLIV	Start simulation of an equipment	12	O		G		
XLLN	Clear local link inhibit bit	10	O	T	G		C J
XLOT	Cancel logging of OTU control & reply bits	8	O	T		A	C
XMES	Stop output of event message	6	O	T	G		C J
XMOV	Remove type 8 (moveable) count detector from an OTU	14	O	T	G		C J
XMVA	Cancel MOVA control mode	10	O	T	G		C J
XPLA	Cancel operator fixed-time plan	8	O	T	G	A	C J
XPRI	Disable log printer	10	O	T	G		C J
XRUB	Delete data previously entered by RUBA command	14	O		G		
XSCO	Cancel SCOOT control	8	O	T	G		C J
XSFN	Re-enable special facility selection	12	O	T	G		C J
XSIG	Cancel sign legend override	12	O	T	G		C J
XSLO	Turn part-time signals on	12	O	T	G		C J
XSPO	Cancel spooled output	4	O				
XSSG	Cancel logging of stage timings data	1	O	T	G	A	C
XSTR	Terminate actioned strategy	12	O	T		A	C
XSUT	Cancel operator timetable	14	O		G		
XTAP	Cancel APS in test mode	10	O	T	G		C J
XTES	Cancel wallmap or SIP lamp test	8	O		G		
XTID	Cancel tidal flow scheme	1	O	T	G	A	C

XTRA	Clear tram priority for a junction	12	O	T	G	C	J
XTRO	Enable output to a terminal	8	O	T	G	C	J
XTTC	Remove command from temporary time table	8	O				
XTUN	Cancel tunnel control	1	O	T	G	A	C

Appendix B - VALU and CHAN Parameters

In the following table each parameter to the VALU and CHAN commands has associated with it the SCOOT SCN level to be associated with it. All parameters can be viewed by the VALU command. The columns under **Type** define whether :

C - The parameter can be altered by the CHAN command;

B - The parameter can be baselined;

U - The parameter is for UTC commands. All other parameters are for SCOOT.

The column **Level** defines the SCOOT command level :

A - Area

R - Region

N -Node

L - Link

S - Stage

D - Detector

* NOTE : The following parameters are modifiable by CHAN as a licensed facility only. Please contact Siemens Traffic Controls for further details.

MAXS, MINS, PRTD, PRTP

Name	Function	Level		
		C	B	U
ADJU	CDC program adjust mode	A	C	
AELG	Area End Lag	A	C	
AFDT	ALMOST FULL Decreasing Threshold		C	U
AFIT	ALMOST FULL Increasing Threshold		C	U
AIEB	Allow improved exit blocking	A	C	B
ALBG	Allow SCOOT background mode	N	C	B
APSR	APS re-run interval	S	C	
ASAL	Allow stage arrive late logic	A	C	B
ASLG	Area Start Lag	A	C	
ASTC	ASTRID Sub Cell	R	C	B
AVLL	AVL Data transmission Lag	A	C	B
BASP	Bus Approach Speed	L	C	B
BCTU	Bus Cruise Time Uncertainty	L	C	B
BDDD	Bus Detected Demand Delay	L	C	B

Name	Function	Level		
		C	B	U
BDOL	Bus distance optimisation limit	L	C	B
BERL	Bus Priority Extension/Recall Strategy	N	C	B
BES0	Bus Link Extension Saturation (Importance 0)	L	C	B
BES1	Bus Link Extension Saturation (Importance 1)	L	C	B
BES2	Bus Link Extension Saturation (Importance 2)	L	C	B
BES3	Bus Link Extension Saturation (Importance 3)	L	C	B
BES4	Bus Link Extension Saturation (Importance 4)	L	C	B
BES5	Bus Link Extension Saturation (Importance 5)	L	C	B
BES6	Bus Link Extension Saturation (Importance 6)	L	C	B
BEXR	Bus Extension Recovery :	N	C	B
BIAS	Offset Bias	L	C	B
BJNY	Bus Journey time from detector	L	C	B
BJT2	Bus Journey Time from Second Trigger Point	L	C	B
BLAT	Bus Late Limit	L	C	B
BLCD	Bus link has cancel detection	L	C	B
BLNK	Bottleneck Link	L	C	
BLSD	Bus link has secondary detection	L	C	B
BOFF	Bus Priority Status	A	C	B
BOTT	Bus On Time Threshold	L	C	B
BPAN	Bus Priority At Node	N	C	B
BPER	Bus Period	A	C	B
BPFL	Bus Priority Flag	L	C	B
BRER	Bus Recall Recovery :	N	C	B
BRS0	Bus Link Recall Saturation (Importance 0)	L	C	B
BRS1	Bus Link Recall Saturation (Importance 1)	L	C	B
BRS2	Bus Link Recall Saturation (Importance 2)	L	C	B
BRS3	Bus Link Recall Saturation (Importance 3)	L	C	B
BRS4	Bus Link Recall Saturation (Importance 4)	L	C	B
BRS5	Bus Link Recall Saturation (Importance 5)	L	C	B
BRS6	Bus Link Recall Saturation (Importance 6)	L	C	B
BSEL	Bus Priority Selection Strategy :	N	C	B
BSLT	Bus Slightly Late Limit	L	C	B

Name	Function	Level		
		C	B	U
BTSM	Bus Traffic Signal Movement	L	C	B
BTSN	Bus Traffic Signal Number	L	C	B
BVLT	Bus Very Late Limit	L	C	B
CACP	Congestion Alarm Clear Percentage		C	U
CAPA	Capacity		C	U
CASP	Congestion Alarm Set Threshold		C	U
CDEF	Calculated Default Stage Length	S		
CDSL	Calculate Default Stage Lengths Status	A	C	
CFBI	Cycle Feedback Inhibit	N	C	B
CGIF	Congestion Importance Factor	L	C	B
CGOF	Congestion Offset Factor	L	C	B
CGWT	Congestion Weighting	L	C	B
CHDI	Cycle Time Historic Data Inhibit	L	C	B
CJNY	VMS to car park journey time		C	U
CLAM	Cycle Lambda Factor	A	C	B
CLAS	Link Class	L	C	B
CLIF	Congestion Link Importance Factor	L	C	B
CLNK	Congestion Link	L	C	
CLUS	Cluster of Trigger Link	L	C	B
CLWT	Congestion Link Weighting Factor	L	C	B
CMJI	Cycle Time Minimum Jump Inhibit	R	C	B
COMP	Composite Link	L	C	B
CONN	Configured Number of N	A		
COPS	Car park occupancy smoothing factor		C	U
CQT1	Queueing Time (Range 1)		C	U
CQT2	Queueing Time (Range 2)		C	U
CQT3	Queueing Time (Range 3)		C	U
CQT4	Queueing Time (Range 4)		C	U
CTFP	Cycle Time Forward Period	R	C	B
CTOI	Cycle Time Optimisation Interval	R	C	B
CYFX	Cyclic Fixed Time	N	C	
CYOS	Cycle Time Optimizer Status	R	C	

Name	Function	Level	Level		
			C	B	U
DAVL	Discard AVL data	L	C	B	
DCIG	Double Cycle Ignore	N	C	B	
DDFL	Demand Dependent Stage Optimisation	S	C	B	
DEFS	Default Stage Length	S	C		
DETL	Number of lanes	L	C	B	
DETU	Detector Used Status	D	C	B	
DFOF	Default Offset	L	C	B	
DFSP	Default Speed	L	C	B	
DGEL	Double Green End Lag	L			
DGSL	Double Green Start Lag	L			
DIVR	Diversion Re-run Interval	A	C	B	
DSTS	Detector Status	D	C		
DUDD	Faulty Detectors	D			
ELAG	End Lag	L	C	B	
ETHR	Detector Empty Fault Threshold	A	C	B	
EXTD	Bus Priority Extend Current Duration	L	C	B	
FCYT	Forced Cycle Time	R	C		
FDTH	FULL Decreasing Threshold		C		U
FDWN	Fast Downward Cycle Times Mode	R	C	B	
FITH	FULL Increasing Threshold		C		U
FLEN	Full Link Length	L	C	B	
FLST	Filter Lower Saturation	N	C	B	
FMUL	Filter Weighing Multiplier	L	C	B	
FORC	Force Single/Double Cycling	N	C		
FSAT	Filter Weighing Saturation	L	C	B	
FTHR	Detector Full Fault Threshold	A	C	B	
FUST	Filter Upper Saturation	N	C	B	
GCAT	Gating Cluster Active Threshold	L	C	B	
GCIT	Gating Cluster Inactive Threshold	L	C	B	
GCLU	Cluster of Gate Link	L	C	B	
GCON	Gate Congestion	L	C	B	
GGAI	Gate gain	L	C	B	

Name	Function	Level	Level		
			C	B	U
GLMG	Gating Low Minimum Green	L	C	B	
GRET	Green/Red Entrance Threshold		C		U
GSAT	Gate Saturation	L	C	B	
GSMO	Green Smoothing Factor	A	C	B	
GUMG	Gating High Minimum Green	L	C	B	
GWPL	Greenwave Plan		C		U
HDLP	Historic Link Profiles Used	L	C	B	
HIST	Historic Occupancy State	L			
IACC	Full/Empty Interval Accumulator	D			
IGFB	enable intergreen feedback	N	C	B	
IGSM	intergreen smoothing factor	A	C	B	
IMPL	SCOOT Control Implemented	N			
INAL	INGRID Alpha - sensitivity of current method	A	C	B	
INBE	INGRID Beta - sensitivity of reference method	A	C	B	
INCO	INGRID minimum confidence level	A	C	B	
INCY	Inhibit Cyclic Optimisation	L	C	B	
INDF	INGRID Detector Fault Status	D			
INFE	INGRID Detector Faulty Empty Limit	A	C	B	
INFF	INGRID Detector Faulty Full Limit	A	C	B	
INFG	INGRID Detector Faulty Good Limit	A	C	B	
INFR	INGRID reporting frequency	A	C	B	
INKE	INGRID keep flag	A	C		
INLD	Inhibit Link Defaults	L	C	B	
INMQ	Inhibit Max Queue Check	L	C	B	
INOF	Inhibit Offset Optimisation	L	C	B	
INS0	INGRID Severity Limit Threshold 0	A	C	B	
INS1	INGRID Severity Limit Threshold 1	A	C	B	
INS2	INGRID Severity Limit Threshold 2	A	C	B	
INS3	INGRID Severity Limit Threshold 3	A	C	B	
INSE	INGRID minimum severity level	A	C	B	
INSP	Inhibit Split Optimisation	L	C	B	
IRCT	Initial Region Cycle Time	R	C		

Name	Function	Level		
		C	B	U
ISAT	Ideal Node Saturation	N	C	B
JNYO	Journey Time Offset On Link	L	C	B
JNYT	Link Journey Time	L	C	B
LFAL	Link Flare Approach Lanes	L	C	B
LFEL	Link Flare Extra Lanes	L	C	B
LFLA	Link Flare	L	C	B
LFMQ	Link Flare Maximum Queue Clear Time	L	C	B
LLEN	Length of a Link	L	C	B
LNKU	Link Used Status	L		
LPUV	User LPU Per Vehicle	L	C	B
LRT1	LRT Saturation Limit 1	N	C	B
LRT2	LRT Saturation Limit 2	N	C	B
LRT3	LRT Saturation Limit 3	N	C	B
LRTS	LRT Stage Permitted	S	C	B
LRTU	LRT UTC Pattern	N	C	B
LSTS	Link Fault Status	L		
LTT1	Link Travel Time Low Delay Threshold	L	C	B
LTT2	Link Travel Time Medium Delay Threshold	L	C	B
LTT3	Link Travel Time Heavy Delay Threshold	L	C	B
LTTF	Link travel time factor	L	C	B
LTTM	Link Travel Time	L		
LTTT	Parameter for link travel calculation	L	C	B
MAXC	Maximum Cycle Time	R	C	B
MAXS	Maximum Stage Length	S	C	
MCLL	Max clear late stage	A	C	B
MDSL	Main Downstream Link	L	C	
MFBI	Model Feedback Inhibit	N	C	B
MINC	Minimum Cycle Time	R	C	B
MINH	MONACO Inhibit	A	C	B
MINS	Minimum Stage Length	S	C	
MMWQ	MONACO Minimum Wasted Queue	A	C	B
MPCY	Minimum Practical Cycle Time	N		

Name	Function	Level		
		C	B	U
MPFR	Maximum Pedestrian Frequency	N	C	B
MPWT	Maximum Pedestrian Waiting Time	N	C	B
MRNI	MONACO Run Interval	A	C	B
MTWQ	MONACO Threshold Wasted Queue	A	C	B
MUJT	MONACO Upper Journey Time	A	C	B
NCMT	No counts message time		C	U
NCYT	Node Cycle Time	N		
NDCG	Node Double Cycling Group	N	C	B
NIGM	New intergreen modelling method for multi-controller Nodes	N	C	B
NMIN	Node Minimum Cycle Time	N		
NOAP	Node Offset Authority Pointer	N	C	B
NOBP	Offset Bus Authority Pointer	N	C	B
NSAP	Node Split Authority Pointer	N	C	B
NSBP	Split Bus Authority Pointer	N	C	B
NSST	Named Stage Start Time	N	C	
NSTG	Named Stage	N		
NTST	Previous and Current Region of a SCOOT Node	N		
OFST	Offset Optimizer Status	N	C	
OFWT	Offset Weighting	L	C	B
OOEW	Offset optimiser emissions weight	N	C	B
OVEP	Bus EP Override Status	N	C	B
PDCC	Pay and display car park correction		C	U
PDCI	Pedestrian Priority Double Cycling Inhibit	N	C	B
PDCM	Permanent Demand Checking Mode		C	U
PEDS	Pedestrian Stage	N	C	B
PLAN	Plan Timings	N		
PLST	Pedestrian Lower Saturation Threshold	N	C	B
PMAX	Bus Maximum Extension Time	N	C	B
PPEL	Permanent Pedestrian Stage Maximum Extension Limit		C	U
PPRI	Pedestrian Priority Level	N	C	B
PRTD	Priority Route Duration		C	U

Name	Function	Level		
		C	B	U
PRTP	Priority Route Plan			U
PUST	Pedestrian Upper Saturation Threshold	N	C	B
QCMQ	Maximum Queue Clear Time	L	C	B
RCYT	Region Cycle Time	R		
RDFE	Reduced Detection Flow Factor	L	C	B
RDFR	Reduced Detection Flow Ratio	L	C	B
RDPF	Reduced Detection Proxy Flow	L	C	B
RDPL	Reduced Detection Proxy Link	L	C	B
RSCT	Resume SCOOT Timings	R	C	B
SATE	Bus Priority Extension Saturation	N	C	B
SATR	Bus Priority Recall Saturation	N	C	B
SETH	Suspect Empty Detector Fault Threshold	A	C	B
SFBI	Split Feedback Inhibit	N	C	B
SFTH	Suspect Full Detector Fault Threshold	A	C	B
SJNY	Soft Journey Time	D	C	B
SKIC	Skipping Inhibit Cycles	N	C	
SKID	Skipping Priority Level Difference	N	C	
SKIF	Skipping Priority Level	N	C	B
SKIH	Skipping Inhibit Period	N	C	
SKIP	Allow Skipping	A	C	B
SKIT	Skipping Inhibit Times	S	C	
SKRM	Bus Skipping Recovery Method	N	C	B
SKTS	Skipping Target Saturation	L	C	
SLAG	Start Lag	L	C	B
SLAM	Split Lambda Factor	A	C	B
SLBI	Stopline Link Bias	L	C	B
SLUL	Stopline Link Upstream Link	L		
SMAN	SOFT Mandatory Status	D	C	B
SMAX	SOFT Maximum Saturation Occupancy	L	C	B
SMIN	SOFT Minimum Saturation Occupancy	L	C	B
SMOI	Split minimum optimisation inhibit	N	C	B
SMOO	Smoothing Factor		C	U

Name	Function	Level		
		C	B	U
SMUL	Split Weighting Multiplier	L	C	B
SNSI	Gas Sensor Collection Interval	A	C	B
SOFT	SOFT status	L	C	
SPEN	Stop Penalty	A	C	B
SPLT	Split Optimiser Status	N	C	
SRST	Stage Removed Status	S		
SSAT	Split Weighting Saturation	L	C	B
STOC	Saturation Occupancy	L	C	B
SUPT	Supplementary Link Type	L	C	B
TACC	ACCT Test Mode	R	C	
TDS1	Decreasing threshold for state change down from 1		C	U
TDS2	Decreasing threshold for state change down from 2		C	U
TIS1	Increasing threshold for state change up to 1		C	U
TIS2	Increasing threshold for state change up to 2		C	U
TPLN	Translation Plan	N	C	
TRAF	Traffic Period for empty detector fault checking	D	C	B
TREN	Cycle Time Trend Status	R	C	B
TSAT	Trend Node Saturation	N	C	B
UNTS	Up Node Through Stage	L	C	
VEHC	Vehicle Occupancy Count		C	U
VLAG	Volume alarm time lag		C	U
VTHR	One Minute Volume Alarm Threshold		C	U

Appendix C - Fault and Advice Details

The following table defines the fault messages and categories which shall be detected and reported by the UTC System. Where a fault shall cause the equipment to be isolated (I) this is indicated, as is the nature of the alarm - System (S) or Operational (O). The reporting of those faults marked H may be inhibited by use of the (licenceable) IFLT command

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>O</u>	<u>H</u>
100	Controller faults				
110	Controller monitoring				
111	Signals stuck in intergreen	I	S		H
112	Signals stuck on stage	I	S		H
113	Signals stuck on minimum	I	S		H
114	Invalid stage transition (for junctions)	I	S		H
114	No vehicle green confirm (for pelicans)	I	S		H
115	Permanent stage demand	I	S		H
116	Permanent intergreen extension	I	S		H
120	Plan compliance				
121	Plan compliance fault	I	S		
122	Stage forced, different stage returned (for junctions)	I	S		H
122	Pedestrian demand not serviced (for pelicans)		S		H
123	Demand dependent stage fault		S		H
130	Lamps/fixed-time/manual		S		
131	Lamps off	I	S		
132	Manual control in operation	I	S		H
133	Remote attended	I	S		H
134	Fixed time	I	S		H
135	CLF		S		H
136	Pelican signals off	I	S		H
137	No break battery failing		S		H
140	Miscellaneous				
141	Type 141 controller fault		S		H
142	Emergency vehicle fault		S		H
143	Invalid phase pattern		S		H
144	Fall-back mode compliance fault		S		
145	Emergency vehicle detected	I	S		H
146	Hurry call detected	I	S		H
147	Hurry call fault		S		H
148	Pedestrian Confirm/Vehicle Green (PC/GX) reply conflict		S		H
149	Lamp failure. Pedestrian stage inhibited		S		H
150	Flashing mode				
151	Flashing mode fault		S		H
160	Controller synchronisation				
161	Controller sync fault		S		H

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>O</u>	<u>H</u>
162	Group timer sync failed		S		H
163	Wrong day of week		S		H
164	Invalid day of week		S		H
165	CS bit stuck		S		H
170	Tidal flow controllers				
171	Control confirmation fault		S		H
172	Unexpected aspect reply change		S		
173	Invalid aspect transition		S		
174	Not responding to force bits		S		
175	Inter-aspect fault		S		
176	Stuck on inter-aspect		S		
177	Stuck on aspect		S		
178	XX aspect not seen		S		
180	Tidal flow controllers				
181	Aspect minimum violation		S		H
182	Urgent fault reported		S		H
183	Minor fault reported		S		H
184	Power fail		S		H
185	Invalid aspect reply		S		
187	RTC Synchronisation fault		S		
188	Emergency close not confirmed		S		
190	LRT controllers				
191	LRT controller surge protection unit status		S		
192	LRT artificial request status		S		
193	LRT detector fault		S		
194	LRT OTU status		S		

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>Q</u>	<u>H</u>
200	Controller timings faults				
210	Intersection timing faults				
211	Minimum green fault		S		H
212	Maximum green fault		S		H
213	Intergreen fault		S		H
214	Extension violation		S		H
220	Pelican timing faults				
221	Min green to vehicles fault		S		H
222	Min non green to vehicles fault		S		H
223	Max non green to vehicles fault		S		H
224	Extension violation		S		H
226	Flashing amber freq. fault		S		H
227	Min pedestrian confirm fault		S		H
228	Max pedestrian confirm fault		S		H

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>O</u>	<u>H</u>
300	Lamp faults				
310	Intersection lamp faults				
311	Identified lamp fault		S		H
312	Identified red lamp fault		S		H
313	Two or more 3 aspect lamp faults		S		H
314	Unidentified lamp fault		S		H
315	Lamp Failure identified by RMLU		S		H
330	Solar lamp faults				
331	Lamp fuse failed		S		H
332	Lamp not dimming fault		S		H
333	Lamp always dim fault		S		H
334	Solar bright fault		S		
335	Part time signals fault, signals on despite turned off by SL bit		S		

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>Q</u>	<u>H</u>
400	Ancillary OSN equipment				
410	VA detector				
411	VA detector fault		S		H
412	SD detector fault				H
413	Permanent SD demand fault				H
420	SCOOT detector				
421	SCOOT detector fault - full		S		
422	SCOOT detector fault - empty		S		
423	SCOOT detector fault - OTU fault		S		
430	Counting detector				
431	Counting detector fault		S		H
432	No counts for last 15 minutes		S		H
440	Car park interface				
441	Car park barrier fault		S		
442	Car park using detector fault		S		
443	Car park state fault		S		
444	Car park vehicle count exceeds capacity		S		
445	Car park vehicle count negative		S		
446	Invalid barrier vehicle count		S		
447	Suspect change of barrier count		S		
448	No change of vehicle count for hours		S		
450	Variable message sign				
451	Sign legend not confirmed	I	S		
452	Sign invalid reply state	I	S		
453	Sign in manual mode	I	S		
454	Sign lamp failure		S		
455	Sign PC link failure		S		
456	Sign isolated				
457	Sign fault (SieSpace)				
458	Sign communication fault (SieSpace)				
460	Pelican push buttons				
461	Push button fault		S		H
462	No pedestrian demand		S		H
463	Permanent pedestrian demand		S		H
464	Permanent pedestrian stage max extension detected		S		H
470	Queue detector				
471	Queue detector fault		S		H
472	Analogue sensors				
472	Analogue sensor fault		S		
473	No sensor data for 5 minutes		S		
474	Sensor level high		S		
475	Sensor level low		S		
476	Sensor OTU fault		S		
477	Sensor under manual calibration		S		
478	Sensor performing own zero check		S		
479	Sensor status channel not healthy		S		

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>O</u>	<u>H</u>
480	Diversion signs				
481	Diversion sign invalid reply state		S		H
482	Diversion sign in manual mode		S		
483	Sign power failure		S		H
484	Sign fault (SieSpace)				
485	Sign communication fault (SieSpace)				
490	Special facilities				
491	Special facility sign invalid reply state	I	S		H
492	Special facility sign in manual mode	I	S		H

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>O</u>	<u>H</u>
500	Transmission system				
510	No response from OTU				
511	TX fault, no reply for three seconds	I	S		
512	Persistent TX fault	I	S		H
513	Intermittent TX fault	I	S		H
514	Configuration mismatch		S		
515	Unit has wrong time		S		
516	Initialisation error		S		
517	Not responding		S		
518	Protocol error		S		
519	Unable to resolve IP address		S		
520	Instation data TX faults				
521	Outstation output stuck	I	S		
522	Outstation isolated by PC fault				
523	Isolated – line in use by upload/download				
524	Outstation disconnected by operator				
525	Offline		S		
530	Instation Telecommand 12 PC faults				
531	PC disconnected	I	S		
532	Intermittent fault	I	S		H
533	Persistent fault	I	S		H
534	Configuration fault	I	S		

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>O</u>	<u>H</u>
600	Instation equipment				
610	Processor				
611	Checkword fault	I			
612	Clocks unsynchronised		S		
613	CPU arithmetic error	I			
620	Discs				
621	System disc not available		S		
622	Data disc not available		S		
630	Inter-processor links				
631	Non-urgent data mismatch fault		S		
640	Terminals				
641	Output timed out		S		
642	Failed to respond		S		
643	Terminal queue time-out		S		
650	External command interfaces				
651	Invalid command received		S		
652	Losing commands		S		

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>Q</u>	<u>H</u>
700	OMU Faults (RMS link to UTC)				
711	OMU power failed		S		
721	Vehicle phase lamp fail		S		
722	Pedestrian phase lamp fail		S		
723	Green arrow lamp fail		S		
724	Wait lamp fail		S		
725	Regulatory signs fail		S		
726	Switched signs bulb fail		S		
727	Pedestrian flash fail		S		
728	Dim/bright fail		S		
729	Vehicle presence fail		S		
731	Vehicle absence fail		S		
732	Lamps off		S		
733	Lamps flashing		S		
734	Controller stuck		S		
735	Controller ignoring demands		S		
736	Short stage minimum green		S		
737	Short phase intergreen		S		
738	Long all red		S		
739	Short stage ext/max		S		
741	Long stage max		S		
742	Long alternative max		S		
743	Long stage extension		S		
744	Conflicting phase green		S		
745	External input active		S		
746	Stage sequencing fault		S		
747	Long interstage period		S		
748	T200/T400 fault log entry		S		
749	GEC3000 fault log entry		S		
751	Ferranti TSC fault log entry		S		

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>			
		<u>I</u>	<u>S</u>	<u>Q</u>	<u>H</u>
800	Ancillary outstation equipment				
810	Remote Requests				
811	Permanent remote request		S		H
820	MOVA Control				
821	MOVA not confirmed		S		H
822	MOVA offline		S		H
823	MOVA fault		S		H
824	MOVA enabled locally		S		H

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>				
		<u>I</u>	<u>S</u>	<u>O</u>	<u>P</u>	<u>H</u>
900	NMCS Equipment					
911	Unobtainable		S		1	H
912	Power fail		S		1	H
913	Set not confirmed		S		1	H
914	Single bulb fail		S		3	H
915	Dual bulb fail		S		1	H
921	Aspect xxxx fail (See note 1 below)		*			H
922	Red flasher fail		S		1	H
923	Mains fail		S		1	H
924	Dimmer failed		S		3	H
925	Amber flasher failed		S		2	H
926	Flasher sync failed		S		1	H
927	Aspect undefined		S		1	H
928	Isolated		S		1	H
931	Printer		S		1	H
932	Operational problem		S		3	H
933	WORM drive		S		3	H
934	Disk 1		S		3	H
935	Disk 2		S		3	H
936	HP disk		S		3	H
937	Motorola disk		S		3	H
938	External clock		S		3	H
939	Mains failed		S		1	H
941	Program failure		S		1	H
942	Self test failed		S		1	H
943	Site data failed		S		1	H
944	Fan failure		S		2	H
945	Line hogging		S		1	H
946	Operator problem		S		3	H
947	Battery charger fault		S		1	H
948	Stepper fault		S		1	H
949	Contraflow		S		3	H
951	PLC fault		S		1	
952	Manual mode		S		3	

The above faults all generate System Alarms but are categorised at different fault priorities, which is indicated by the number in the last column. If used in graphics, faults in priority 1 cause a Red border to be shown, in priority 2 they result in a Magenta border and in priority 3 a yellow border.

Note 1 :- The string "xxxx" identifies the aspect failing, and can be any of the valid aspects. The aspects strings normally encountered are listed below and these failures are assigned to fault priority 1. Other aspect faults are assigned to fault priority 3.

NULL, END, RE STOP, 20, 30, 40, 50, 60, 70, LDR, X, LDL, MDL, IT, TI, 1(C) [arrow], MDR, FOG, Q and AMB.

<u>Cat</u>	<u>Fault Message</u>	<u>Type</u>		
		<u>I</u>	<u>S</u>	<u>Q</u>
	Operational faults			
OPE	Queue formed			O
OPE	Congestion formed			O
OPE	Volume detector on			O
OPE	SCOOT sub-system on-line			O
OPE	Plan due - operator override			O
OPE	SCOOT control due			O
OPE	APS plan due			O
OPE	Diversion plan due			O
OPE	System log 100% full			O
OPE	Emergency vehicle detected			O
OPE	Hurry call detected			O

Appendix D - UTC System Capacity

The numbers of equipments and facilities which are available to the user of an STC UTC System are dependent upon the particular hardware and software configuration of the System.

There are 3 UTC System configurations available:

- (1) PC SCOOT
- (2) An Alpha computer with a standard software build
- (3) An Alpha computer with a Special Edition (SE) software build

The software for an STC UTC System shall be designed to be capable of handling or controlling the maximum number of equipment/facilities shown in the following table given a computer of sufficient power:

	PC SCOOT	Alpha Standard Build	Alpha SE Build
System Wide Limits:			
Sub-areas	999	99	999
SCOOT Regions	676	676	676
Users	64	64	64
Logged in Users	35	35	35
Timetable Events (per timetable)	1500	1500	1500
CASTs	1000	1000	1000
CAST Commands	20000	20000	20000
TCCs	8	8	8
Timetables (day-of-week)	20	20	20
Plans: Fixed-time	40	40	40
Plans: SCOOT	6	6	6
Plans: Greenwave	320	100	320
Per TCC Limits:			
Outstations	1000	1000	1000
Junction Controllers	750	300	650
Pedestrian Controllers	300	300	300
Special Facilities	1200	600	1200
Remote Requests	244	244	244

	PC SCOOT	Alpha Standard Build	Alpha SE Build
User-defined Remote Requests	1000	256	1000
Count Detectors	600	600	600
Queue Detectors	100	100	100
Diversions	20	20	20
Diversion Signs	80	80	80
Ripple Diversion	50	50	50
Greenwave Routes	320	100	320
Equipment on a greenwave	64	64	64
Simultaneous Routes	16	16	16
Controller Linked Lists	200	99	200
Car Parks	30	30	30
Car Park Signs	200	200	200
OMUs	300	300	300
TC12 PCs	8	8	8
Ports per TC12 PC	64	64	64
Analogue Sensors	200	200	200
Sensor Groups	100	100	100
Regions	230	100	200
Nodes	750	300	650
Stages	3000	1500	2500
Links	3000	1500	2500
SCOOT Detectors	3500	1800	3000
Double Green Links	230	100	200
SOFT Links	700	400	600
SOFT Detectors	800	500	700

Notes:

1. In the above, both diversion and car park signs shall refer to a single variable element.
2. The System-wide totals represent the absolute maximums, i.e. it is not possible to have a system consisting of 8 Control Computers each controlling 100 SCOOT regions.

3. The exact number of equipments controllable by a particular hardware configuration shall depend on the processor power and shall be defined in the UTC System's CRS.
4. The maximum number of SCOOT nodes which may be controlled by a UTC System is set by the number of licenced SCOOT nodes rather than System capacity.

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Telnetd

Telnet daemon.

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WinPcap

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