Generic LED Charge Codes

1. Background

One of the most common issues raised by our customers in recent years had been the "explosion" of ELEXON charge codes (also known as "UMSUG codes"). Originally, a 150W SON lamp (with standard / magnetic control gear) would have the same generic charge code irrespective of the manufacturer.

This made adding charge codes to the asset management system straightforward. By selecting a lamp type from a drop down list (SON is always **14**), the wattage (150W = **0150**) and then the control gear (magnetic = **1**), this created the following 7 digit charge code: **14**0150**1**.

This worked well up until the technological revolution of recent years with the introduction of electronic control gear, dimming and LED light sources. As a result of the increasing complexity in 2008 ELEXON introduced 13 digit charge codes. So the above charge code became:
14 0150 1**000 100.**

Electronic control gear led to lower circuit wattages and slight differences in those wattages depending on the manufacturer. In turn, this led to individual, manufacturer specific charge codes. These were a selling point for manufacturers as they were able to demonstrate additional savings compared to rival manufacturers.

This was manageable for a while but with the universal uptake of LED lighting, single watt increments, multi-level dimming, and Constant Light Output (CLO) the charge code list grew rapidly and became unmanageable.

2. Implemented Solution

The Unmetered Supplies User Group (UMSUG) advises ELEXON, this group includes representatives from the unmetered electricity industry (including PDA) as well as lighting industry practitioners. ELEXON consulted widely with UMSUG and also with Local Authorities, the ILP, LED manufacturers, CMS suppliers and various asset management system providers to consider a range of issues. The key customer desire was a reduction in "charge code proliferation" but also to avoid any "unintended consequences".

Using the charge code spreadsheet itself and filtering on a specific manufacturer to identify the correct charge code was not necessarily the issue, however setting up the charge codes in the asset management system was a major concern. The consultation responses identified that reverting to the use of the same generic charge codes for different manufacturers was not a problem, 40 watts is 40 watts irrespective of who sells it. Many inventory systems have a separate entry for the luminaire make & model which will become essential as it will not be possible to reverse engineer the make and model from the generic LED charge codes.

There was some unease over how to check the manufacturer has ELEXON approval for their product. In order to ensure that their customers receive the promised energy reductions, most manufacturers are engaged in the ELEXON charge code approval process. However, the published generic charge codes could be misused if a disreputable manufacturer claimed their equipment was approved by ELEXON and telling customers to use a generic charge code. This was resolved with the publication of a simple list of approved manufacturer's equipment showing the range of wattages for that equipment.

After a positive response from respondents, the following was implemented:

- a new range of generic LED charge codes was created to be used for LED street lighting and LED illuminated signs (but not for traffic signals) that began "42…"
- these are all based on the 100% power rating, i.e. charge code will always end "…100"
- a new range of Variable Power Switch Regimes has been created for any dimming
- dimming is in 5% bandings
- a separate spreadsheet showing the manufacturer's approval is published by Elexon
- existing charge codes remained valid, no need to change (however no new LED codes will be published outside of the generic range)

ELEXON have produced (and recently updated) two guidance documents, one for customers[1] and one for manufacturers[2].

3. How will dimming work?

3.1. Central Management Systems

When using a Central Management System (CMS) nothing changed with the introduction of generic LEDs. Use a switch regime of 999 and the appropriate 100% charge code. All of the dimming profiles set up in the CMS are captured by the daily CMS event log file. Dimming can be applied at any percentage power that the driver/lamp supports (the 5% bandings do not apply).

3.2. Ballast/driver

Where the dimming is pre-programmed by the ballast/driver then there was a change. Multi-Level Static Dimming (MLSD) switch regimes were renamed Variable Power Switch Regimes (VPSR).

VPSR is now used for all new dimming regimes, covering both single step dimming and multi-level dimming. The VPSR (identical to MLSD) has a three character alpha-numeric switch regime code, detailing the times that the dimming applies and the percentage powers at those times.

To prevent a proliferation of switch regimes codes the dimming is banded to the nearest 5%. A lamp operating at 62% of full power is rounded down to 60% (63% is rounded up to 65%).

Example Charge Code and VPSR:

A 100W generic LED luminaire is being dimmed as follows:

- switching levels at 35/18 lux
- full power from dusk to 22:00
- operating at 75% of full power between 22:00 and midnight
- operating at 60% of full power midnight to 06:00
- returning to full power from 06:00 to dawn

The charge code is **42 0100 0000 100**, together with a VPSR of **D16**.

Existing single step dimming switch regimes (e.g. 526) can still be used with existing dimmed LED charge codes (e.g. 41 0090 0010 **050**). There is no need to change inventories for existing approved codes.

[1] www.elexon.co.uk/documents/training-guidance/bsc-guidance-notes/led-customer-generic-guidance/
[2] www.elexon.co.uk/documents/training-guidance/bsc-guidance-notes/led-charge-codes-guidance-for-manufacturers-application-process-generic/

4. Clock time versus middle of night

When single step dimming was first introduced, the ballasts were described as using the middle of night for timing. They measured the hours of operation each night for several nights and could then work out when the middle of night would occur (i.e. midnight in GMT).

It did not matter if that night in the year was during BST or GMT, it simply calculated when the middle of the night occurred. So, all ELEXON dimmed switch regimes were issued on the basis of switching events being in GMT all year round.

The majority of drivers/ballasts in the market today are programmed to also calculate the time of year and adjust for the BST/GMT clock changes.

Adjusting for the BST/GMT changes is referred to as clock time dimming by ELEXON and delivers extra savings. Manufacturers should be able to advise if their products adjust for clock changes or not.

To use the correct switch regime, check the switch regime in the Unmetered Supplies Operational Switch Regimes spreadsheet on the Elexon Charge Codes and Switch Regimes page[3] of their website. There is a column in the spreadsheet that identifies if the switch regime operates in clock time(CLK) or GMT. The VPSR list which is also published on the same page similarly identifies if the switching times are based on clock time or permanent GMT. Our report includes 'GMT' or 'Clock' in the description of all the switch regimes where timed switching is used.

Worked Example:

Description	Bright Hours	Dimmed Hours	Total Hours
70/35 Dimmed from 00:00 to 05:00 (GMT)	2,466	1,675	4,141
70/35 Dimming from 00:00 to 05:00 (Clock)	2,182	1,959	4,141

- 50W LED dimmed to 70% from midnight to 05:00 using 70/35 lux
- Full power circuit watts = 50, dimmed watts = 35
- Cost assumed to be 15 p/kWh
- kWh = ((Bright hours x full power watts) + (dimmed hours x dimmed watts)) / 1,000

Non GMT/BST adjusting kWh = 181.9kWh or £27.29

'Clock' adjusting kWh = 177.7kWh or £26.66

Difference from the clock time dimming = an additional £635/year (for 1000 lamps)

5. Reduced Operation

This should not be confused with dimming, where the light output is dimmed for part of the night. Reduced operation allows manufacturers to offer the same lantern with the LED driver set to different power outputs delivering reduced light output for all of the night. This can also extend the life of the luminaire.

[3] www.elexon.co.uk/operations-settlement/unmetered-supplies/charge-codes-and-switch-regimes/

Where the driver is operating at a reduced power level the charge code to be used reflects the driver setting. For example, the same driver can be set to run one luminaire at 100W and another luminaire with the same driver and LED module configuration could be set to run at 80W. Both luminaires are deemed to be operating at 100% power for the purposes of selecting a charge code.

The charge codes for these examples would be 42 **0100** 0000 100 and 42 **0080** 0000 100 respectively.

It is possible that a luminaire could be set to run at reduced operation, but also dimming for part of the night. Taking the 100W luminaire above that has been set to switch on at 80W, and then dimmed to 50W for part of the night, the charge code to use is still 42 **0080** 0000 100 but associated with a VPSR to factor in the dimming.

6. Constant Light Output

There are various names for Constant Light Output (CLO) but ultimately it describes the energy saving that is made possible by removing the "over lighting" of a design that allows for lumen depreciation over time. A lighting scheme is typically designed based on a lamp's lumen output at the end of its life, which is lower than at the start. This means most schemes are "over lit" for much of the duration of the lamp's life. Constant Light Output uses the projected lumen output of the lamp gradually increasing the power to the lamp over time so that the lumen output remains constant. This saves energy by not "over lighting" the installation from day 1. There are two methods of controlling CLO and it is important that the correct charge code is selected.

6.1. CMS controlled CLO

Where the CMS controls the CLO based on the hours run and age of the equipment then:

- Enter the charge code that reflects the circuit watts the lamp will consume at end of life

The CMS will then do the rest automatically, for example, it will register that it is operating at 80% of full power on day 1, 83% on day 600, and so on until it reaches 100% during the last few days before replacement.

6.2. Driver/ballast controlled CLO

Where the driver/ballast is pre-programmed with CLO then:

- Enter the charge code for the wattage that is the midpoint between the start and end of life

If for the same lumen output the lamp is designed to consume 100W at the start of life and 150W at the end of its life then the charge code in the inventory should be for 125W, 42 0125 0000 100.

The equipment manufacturer should be able to advise the correct charge code to use determined by how the lamp will be operated and controlled.

Power Data Associates will continue to monitor changes to the Generic Charge Codes and update this guidance. For the latest position or for more information please contact us.

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