



Aurora Energy Limited

Load Management System
Guide for Retailers and Receiver Owners (NS5.4)

Status and Application of this Guide

This guide provides information on the basic parameters of Aurora's load management system. If any aspect of this guide is considered unclear, clarification should be sought from the Network Services Manager at *DELTA*.

This guide will be amended periodically, to reflect changes required for continued compliance with legislation and good industry practice. It is recommended that electricity retailers and receiver owners review this guide periodically. The current version of this guide will be maintained on Aurora's website (www.auroraenergy.co.nz), and will apply from the date of publication.

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Version Control			
Version	Date	Summary of Significant Amendments	Approved
1.1	1 June 2010	Migration to 317Hz signal injection in Dunedin advised.	LRM
1.2	1 July 2010	Day/night metering arrangements in Central Otago clarified	LRM
1.3	1 June 2011	Channels for plug in electric vehicles added	LRM
1.4	1 Aug 2011	Channel 100-00 removed Central Otago area	LRM

1. INTRODUCTION

This document provides information on the Load Management system operated by Aurora Energy Limited (Aurora). This information is generally provided for use by electricity retailers, and their metering equipment providers and contractors.

2. LOAD MANAGEMENT SYSTEM

Aurora operates a load management system for a number of key purposes relating to operational management of the electricity network. These include:

- Reducing capital investment in the distribution network by encouraging consumers to shift demand from peak periods to off peak periods, and thus enabling lower line charges to electricity retailers and, in turn, electricity consumers.
- Reducing peak loads at Transpower substations and at times of peak regional demands thereby reducing Transpower connection charges and thus enabling lower line charges to electricity retailers and, in turn, electricity consumers.
- Signalling the occurrence of higher priced congestion periods to consumers, enabling them to take avoidance action through their own demand management systems.
- Lowering demand on the electricity network during fault restoration.

Aurora's load management system is also used to provide a range of customer services, including:

- Transferring storage heating loads (water heating, underfloor heating and night-store heating) to less expensive tariff periods.
- Switching street and amenity lighting on and off.
- Providing energy tariff options to electricity retailers.

Aurora's load management system comprises a range of ripple signal injection devices located at key zone substations. In the Dunedin network, a ripple signal is injected into the 6.6kV and 11kV distribution lines and cables at a nominal frequency of 1050Hz and a 317Hz signal is injected into the 33kV distribution lines. For the Central Otago network the ripple signal is injected into the 33kV distribution lines at a frequency is 317Hz.

Only 317Hz relays should be installed in the Dunedin area. The older Dunedin 1050Hz system will be decommissioned on an area by area basis and details will be provided to other parties on request.

Multiple commands are created by varying the nature of the ripple signal injected by the load management system. Receivers are placed at consumers' installations, and contain up to three relays that are programmed to specific commands. Upon receiving a ripple signal matching its programmed command, the relay activates and changes state to either 'on' or 'off'. The receivers on the Aurora network are owned by either electricity retailers or third-party metering equipment providers. The only receivers owned by Aurora are located within distribution substations to provide the switched street lighting supply.

The older 1050Hz load management system in Dunedin is a compound K22 / Decabit system, manufactured by Zellweger Uster (now Enermet/L&G). The compound K22 / Decabit system allows existing electromechanical receivers to remain in service; although these are expected to be replaced by asset owners over time and the 317Hz system is a pure Decabit system. The Central Otago system is a pure Decabit system and in some subdivisions pilot wire relays are controlled by a Decabit receiver located at distribution substations. When failures of the pilot wire occur then it has been agreed with retailers that the pilot wire relays are replaced by Decabit receivers at the consumer meter board.

For new installations, both the Dunedin and Central Otago systems offer 100 individual commands and 19 master commands. Each individual command may be invoked separately; however it is sometimes necessary to quickly manage large blocks of load, therefore individual commands are normally assigned master commands that allow collective operation. The current allocation of load management commands is shown in Appendix A.

3. LOAD MANAGEMENT

The facility to manage certain loads at peak times allows Aurora to reduce associated costs, including Transpower charges. At present the only load that Aurora makes load management mandatory is the charging of Plug in electric vehicles (PIEVs) as these new loads will have a significant impact on future network investment if not controlled. Economic signals encouraging the installation of ripple receivers to allow load management are provided through lower line charges for managed loads. Additionally, electricity retailers can offer lower tariffs.

The following loads must be controlled:

- Plug in electric vehicles on a 8 hour service at night.

Since savings are available to consumers permitting load management of their installation, it is recommended that the following appliances be controlled:

- Storage water heaters.
- Residential storage water heaters above 135 litres.
- Storage space heaters.
- Underfloor heating.
- Electric kilns.
- Spa and swimming pools.

Modern load management relays can directly switch resistive loads up to 9kW. Loads in excess of 9kW will require a contactor to be supplied and installed at the consumer's cost. Three phase load also require installation of an appropriately rated contactor.

Further information regarding line charges for managed and off peak time period loads is available in Aurora's [Network Connection Requirements](#) and [Use of System Pricing Methodology](#) documents.

4. RECEIVER FILTER PARAMETERS

1050Hz Injection: The standard settings for the filter are 1042Hz, 0.5% U_f (operate voltage), Broad (6%) filter bandwidth. No new relays to be installed.

317Hz Injection: The standard settings for the filter are 317Hz, 0.5% U_f (operate voltage), Narrow (3.9%) filter bandwidth.

5. RECEIVER RELAY POSITION - Day / Night Switching - Congestion Period

Dunedin - Zellweger / Enermet receivers - The meter is on the low rate when the contact indicator is up or in **position A**. For meters with day/night registers the standard wiring is such that the night register is in the left hand or top position of the meter.

Central Otago - Zellweger / Enermet receivers - The meter is on the low rate when the contact indicator is down or in **position B**. For meters with day/night registers the standard wiring is such that the night register is in the left hand or top position of the meter and is achieved via a changeover contact in the receiver relay.

Both areas - Zellweger / Enermet receivers - The relay is ON when the Congestion Period is being signalled.

6. RANDOM INDIVIDUAL COMMAND ALLOCATION

For various load management applications, such as domestic water heating, a range of individual commands are available. Metering contractors preparing receivers for service must ensure that commands are allocated on a random basis, to ensure that no individual command controls a disproportionately sized load. It is important in new residential subdivisions that as many different commands as possible are used for new connections in a subdivision.

Where only two individual commands are allocated to a particular load management application, receivers being programmed for this application should have the individual commands evenly allocated. Applications requiring random command allocation are listed below:

Dunedin

Application	Commands to be Randomly Allocated
Domestic water heating	00; 01; 02; 03; 04; 05; 06; 07; 08; 09

Central Otago

Application	Commands to be Randomly Allocated
Domestic water heating	01; 02; 03; 04; 05; 06; 07; 13; 14
Off-peak storage heating (13hr)	08; 09; 10

7. RANDOM SWITCHING TIME DELAY

To ensure that large load changes are avoided, time delays are required to be employed for certain applications when load is restored. Time delays are to be of a random duration between 0 and 60 seconds, and must occur regardless of whether the application is initiated by individual or master command. The maximum time delay of 60 seconds is chosen as a balance between minimising voltage changes and the necessity to restore load as quickly as possible so that optimum performance of the load management decisions when undertaking load control. Time delays are not to occur when load is switched off.

The following applications are to employ random time delays. All other applications require immediate switching.

Dunedin

Application	Commands Requiring Random Time Delay
Domestic water heating	00; 01; 02; 03; 04; 05; 06; 07; 08; 09
Domestic thermal (kilns, spas, etc.)	20
Domestic hot water (no load shift)	21
General controllable load	31
Commercial hot water	33
Commercial storage heating	34

Central Otago

Application	Commands Requiring Random Time Delay
Domestic water heating	01; 02; 03; 04; 05; 06; 07; 13; 14
Peak controlled water heating	11

Note that in association with the above commands the relay will switch off on loss of power. After restoration of power the relay should return to the memory position after 10 minutes.

8. LEARN FUNCTION

This feature is to be enabled for time based programs to provide a back-up feature should there be short term issues with signal injection.

The following parameters are required to be set for the commands listed in the table below;

- Failsafe enabled after 24 hours since the last signal
- Learn function enabled

The following applications are to have the learn function enabled

Dunedin

Application	Commands Requiring Learn Function
Plug in electric vehicles	36,37,38
General night load	39
11hr storage heating	40
8hr storage heating	42
Day / Night Meter register changeover	50

Central Otago

Application	Commands Requiring Learn Function
Off-peak storage heating (13hr)	08; 09; 10
Plug in electric vehicles	36, 37, 38
Irrigation pumps	50
Day / Night Meter register changeover	52
Water or storage heating (11hr)	53; 54
Night only	58
Budget water heating (11hr)	59

9. LOAD SHIFTING

Water heating loads may also be load shifted in accordance with the protocols with electricity retailers as set out in the Use of System Agreement.

10. UNDER-FREQUENCY SHED CAPABILITY

If receivers have this capability, the enable / disable and test commands are to be set to the commands as listed in the tables in Appendix A for the Dunedin and Central Otago areas. The shed command is to be linked to relays associated with the commands listed below.

At present newly installed receivers should be set to have this function disabled (but able to be enabled by the appropriate Decabit command) as no arrangements are in place for this service.

Dunedin

Application	Commands Linked to Under-frequency Shed
Domestic water heating	00; 01; 02; 03; 04; 05; 06; 07; 08; 09
Domestic thermal (kilns, spas, etc.)	20
Domestic hot water (no load shift)	21
General controllable load	31
Commercial hot water	33
Commercial storage heating	34
Plug in electric vehicles	36, 37, 38
General night load	39

11hr storage heating	40
8hr storage heating	42

Central Otago

Application	Commands Linked to Under-frequency Shed
Domestic water heating	01; 02; 03; 04; 05; 06; 07; 13; 14
Off-peak storage heating (13hr)	08; 09; 10
Peak controlled water heating	11
Plug in electric vehicles	36, 37, 38
Irrigation pumps	50
Water or storage heating (11hr)	53; 54
Night only	58
Budget water heating (11hr)	59

The low frequency load shedding parameters should be set as follows;

Frequency - 49.2Hz

Detection time - 200ms (10 cycles)

Off time - 15 minutes with random restore of 60 seconds.

11. CONGESTION PERIOD DEMAND (CPD) SIGNAL

A congestion period demand signal is available and is initiated automatically at any time when Aurora is managing load. This signal allows consumers to reduce or avoid their demand during higher priced congestion periods by operating “peak-reducing” generators, building management systems, or providing a simple notification (signal lamp or alarm) to allow the consumer to manually switch off significant loads. Provision of the CPD signal is therefore normally restricted to commercial and industrial installations with demand exceeding 150kVA, along with practical scope to transfer demand away from congestion periods.

The monthly forecast of congestions periods (based upon average pattern over the last 5 years) is presented on the Aurora website, along with recent congestion period history. Further information on CPD pricing is available in Aurora’s [Use of System Pricing Methodology](#).

12. NEW SERVICES

Aurora has unallocated commands in both the Dunedin and Central Otago load management systems that may be used to provide new services. Some charges may apply for setup and on-going maintenance of the service.

It must be noted that commands should be used for their intended purpose only (load management, tariff changing, etc) and Aurora accepts no responsibility for the consequences of incorrect or misused channel assignments.

APPENDIX A - LOAD MANAGEMENT COMMAND ALLOCATIONS

Dunedin

Master	Ind	1050Hz Type	317Hz Type	Description	Notes
100	00	DK(4)	D	Domestic hot water	Minimum 16hr service target
100	01	DK(5)	D	Domestic hot water	Minimum 16hr service target
100	02	DK(6)	D	Domestic hot water	Minimum 16hr service target
100	03	DK(7)	D	Domestic hot water	Minimum 16hr service target
100	04	K(8)	D	Domestic hot water	Minimum 16hr service target
101	05	K(9)	D	Domestic hot water	Minimum 16hr service target
101	06	K(10)	D	Domestic hot water	Minimum 16hr service target
101	07	K(11)	D	Domestic hot water	Minimum 16hr service target
101	08	D	D	Domestic hot water	Minimum 16hr service target
101	09	D	D	Domestic hot water	Minimum 16hr service target
102	10	D		Spare	
102	11	D		Spare	
102	12	D		Spare	
102	13	D		Spare	
102	14	D		Spare	
103	15	D		Spare	
103	16	D		Spare	
103	17	D		Spare	
103	18	D		Spare	
103	19	D		Spare	
103	20	D	D	Domestic thermal (kilns, spas, etc.).	Minimum 16hr service target
103	21	D		Domestic hot water (no load shift)	Minimum 16hr service target
103	22	D		Spare	
103	23	D		Spare	
103	24	D		Spare	
105	25	D		Spare	
105	26	D		Spare	
105	27	D		Spare	
105	28	D		Spare	
105	29	D		Spare	
	30	D		Interruptible load	No longer used
106	31	D		General controllable load	
106	32	D		Church heating	No longer used

Master	Ind	1050Hz Type	317Hz Type	Description	Notes
106	33	D	D	Commercial hot water	Minimum 16hr service target
106	34	D	D	Commercial storage heating	Minimum 16hr service target
107	35	D		Spare	
107	36		D	Plug in electric vehicles	Off, 0600 - 2200
107	37		D	Plug in electric vehicles	Off, 0630 - 2230
107	38		D	Plug in electric vehicles	Off, 0700 - 2300
107	39	D	D	General night load	Off, 0700 - 2300
108	40	DK(17)	D	11hr Storage heating.	Off, 0700 - 1330 & 1630 - 2300
108	41	D		Spare	
108	42	D	D	8hr Storage heating	Off, 0700 - 2300
108	43	D		Spare	
108	44	D		Spare	
109	45	D		Spare	
109	46	D		Spare	
109	47	D		Spare	
109	48	D		Spare	
109	49	D		Spare	
110	50	D	D	Day / night register change	Off, 0700 - 2300
110	51	D		Spare	
	52	D	D	Congestion period demand	On when Congestion period On, Normally Off
	53	D	D	Under frequency load shedding enable	
	54	D	D	Under frequency load shedding test	
111	55	D	D	Street lighting - Arterial roads	Off, dawn - dusk
111	56	D	D	Street lighting - Suburban roads	Off, dawn - dusk
111	57	D		Spare	
111	58	D		Spare	
111	59	D		Spare	
112	60	D	D	Zone substation 2% voltage control	Emergency use only
112	61	D	D	Zone substation 3% voltage control	Emergency use only
112	62	D			
112	63	D			
112	64	D			
	65	D		Consumer signalling	No longer used
	66	D		Block channel 65, emergency test run.	No longer used
	67	D		Interruptible load warning	No longer used
112	68	D		Spare	
112	69	D		Spare	

Master	Ind	1050Hz Type	317Hz Type	Description	Notes
114	70	D		Spare	
114	71	D		Spare	
114	72	D		Spare	
114	73	D		Spare	
114	74	D		Spare	
114	75	D		Spare	
114	76	D		Spare	
114	77	D		Spare	
114	78	D		Spare	
114	79	D		Spare	
116	80	D		Spare	
116	81	D		Spare	
116	82	D		Spare	
116	83	D		Spare	
116	84	D		Spare	
117	85	D		Spare	
117	86	D		Spare	
117	87	D		Spare	
117	88	D		Spare	
117	89	D		Spare	
118	90	D		Spare	
118	91	D		Spare	
118	92	D		Spare	
118	93	D		Spare	
118	94	D		Spare	
	95	D		Spare	
	96	D		Spare	
	97	D		Spare	
	98	D		Spare	
	99	D		Spare	

Central Otago

Master	Individual	317Hz Type	Description	Notes
100	00	D	Spare	
100	01	D	Domestic hot water	Minimum 16hr service target
100	02	D	Domestic hot water	Minimum 16hr service target
100	03	D	Domestic hot water	Minimum 16hr service target
100	04	D	Domestic hot water	Minimum 16hr service target
100	05	D	Domestic hot water	Minimum 16hr service target
100	06	D	Domestic hot water	Minimum 16hr service target
100	07	D	Domestic hot water	Minimum 16hr service target
100	08	D	Off-peak storage heating (13hrs)	Off, 0730-1000; 1200-1500; 1700-2000; 2200-0300
100	09	D	Off-peak storage heating (13hrs)	Off, 0730-1010; 1210-1505; 1705-2010; 2210-0300
100	10	D	Off-peak storage heating (13hrs)	Off, 0730-1020; 1220-1510; 1710-2020; 2220-0300
100	11	D	Peak controlled water heating	Minimum 20hr service target
100	12	D	Spare	
100	13	D	Domestic hot water	Minimum 16hr service target
100	14	D	Domestic hot water	Minimum 16hr service target
100	15	D	Spare	
	16	D	Spare	
	17	D	Spare	
	18	D	Spare	
	19	D	Spare	
	20	D	Spare	
	21	D	Spare	
	22	D	Spare	
	23	D	Spare	
	24	D	Spare	
	25	D	Spare	
	26	D	Spare	
	27	D	Spare	
	28	D	Spare	
	29	D	Spare	
	30	D	Spare	
	31	D	Spare	
	32	D	Spare	

Master	Individual	Type	Description	Notes
	33	D	Spare	
	34	D	Spare	
	35	D	Spare	
107	36	D	Plug in electric vehicles	Off, 0600 - 2200
107	37	D	Plug in electric vehicles	Off, 0630 - 2230
107	38	D	Plug in electric vehicles	Off, 0700 - 2300
	39	D	Spare	
108	40	D	Street lighting - Alexandra & Queenstown	Off, dawn - dusk
108	41	D	Street lighting - Earnsclough & Frankton	Off, dawn - dusk
108	42	D	Street lighting - Clyde & Dalefield	Off, dawn - dusk
108	43	D	Street lighting - Omakau, Maungawera, & Arrowtown	Off, dawn - dusk
108	44	D	Street lighting - Roxburgh, Queensberry, & Glenorchy	Off, dawn - dusk
108	45	D	Street lighting - Ettrick, Wanaka, & Fernhill	Off, dawn - dusk
108	46	D	Street lighting - Roxburgh Hydro, Cromwell, & Closeburn	Off, dawn - dusk
108	47	D	Reserved for future street lighting control.	
108	48	D	Reserved for future street lighting control.	
108	49	D	Reserved for future street lighting control.	
110	50	D	Irrigation pumps (14hr)	Off, 0700-1100; 1500-2100 (June to August only)
	51	D	Congestion period demand	On when Congestion period On, Normally Off
	52	D	Day / night tariff change	Off, 2300-0700
	53	D	Water or storage heating (11hr)	Off, 0710-1330; 1630-2310
	54	D	Water or storage heating (11hr)	Off, 0720-1300; 1600-2320
	55	D	Under frequency load shedding enable	
	56	D	Under frequency load shedding test	
	57	D	Spare	
	58	D	Night only	Off, 0700-2300
	59	D	Budget water heating (11hr)	Off, 0700-1030; 1230-1600; 1700-2330
	60	D	Reserved for switching Aurora equipment	
	61	D	Reserved for switching Aurora equipment	
	62	D	Reserved for switching Aurora equipment	
	63	D	Reserved for switching Aurora equipment	
	64	D	Reserved for switching Aurora equipment	
	65	D	Reserved for switching Aurora equipment	
	66	D	Reserved for switching Aurora equipment	

Master	Individual	Type	Description	Notes
	67	D	Reserved for switching Aurora equipment	
	68	D	Reserved for switching Aurora equipment	
	69	D	Reserved for switching Aurora equipment	
	70	D	Alexandra & Queenstown substation group	
	71	D	Earnsclough & Frankton substation group	
	72	D	Clyde & Dalefield substation group	
	73	D	Omakau, Maungawera, & Arrowtown substation group	
	74	D	Roxburgh, Queensberry, & Glenorchy substation group	
	75	D	Ettrick, Wanaka, & Fernhill substation group	
	76	D	Roxburgh Hydro, Cromwell, & Closeburn substation group	
	77	D	Reserved for future substation groups	
	78	D	Reserved for future substation groups	
	79	D	Reserved for future substation groups	
	80	D	Spare	
	81	D	Spare	
	82	D	Spare	
	83	D	Spare	
	84	D	Spare	
	85	D	Spare	
	86	D	Spare	
	87	D	Spare	
	88	D	Spare	
	89	D	Spare	
	90	D	Spare	
	91	D	Spare	
	92	D	Spare	
	93	D	Spare	
	94	D	Spare	
	95	D	Spare	
	96	D	Spare	
	97	D	Spare	
	98	D	Spare	
	99	D	Spare	