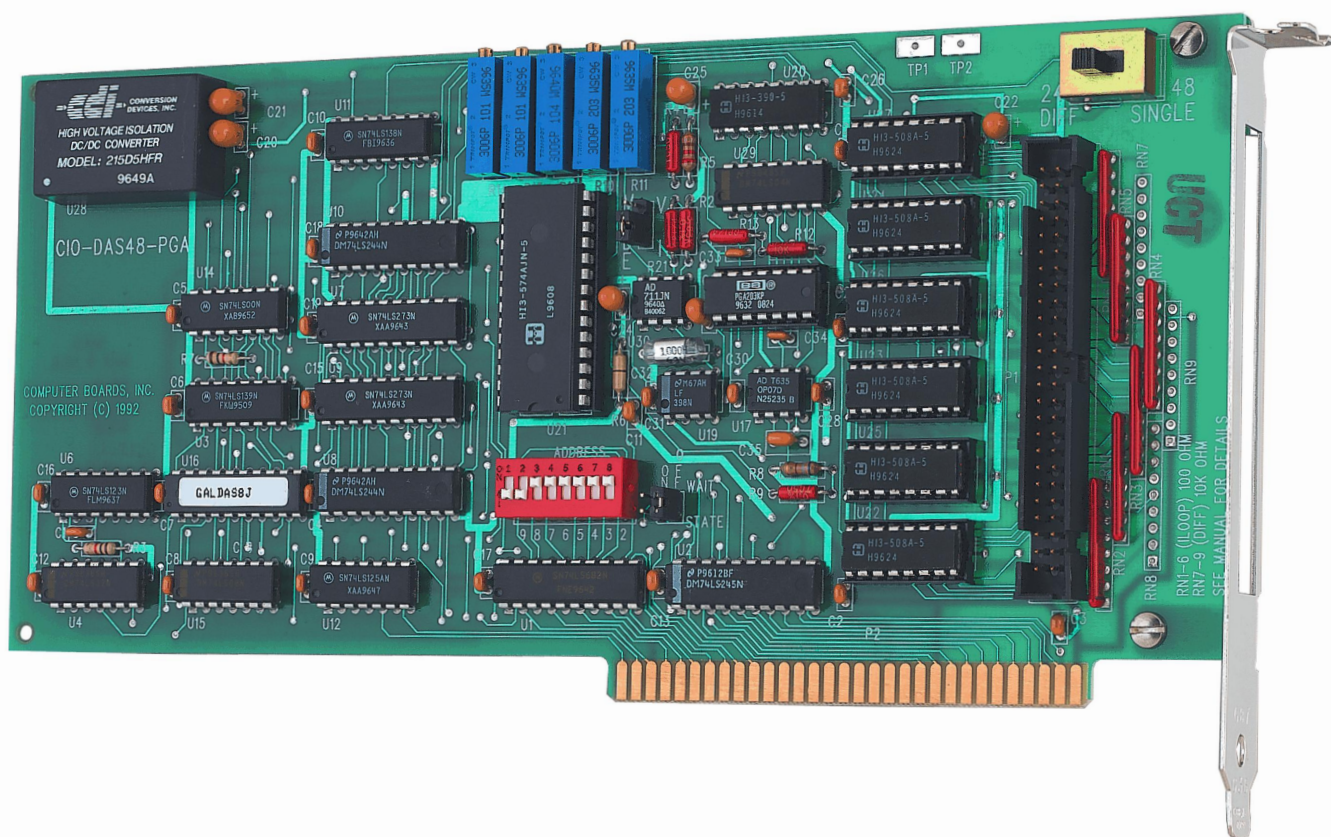


# CIO-DAS48-I

Current Input

## User's Guide



# **CIO-DAS48-I**

## **Analog Current Input**

### **User's Guide**



**MEASUREMENT  
COMPUTING™**

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## About this User's Guide

### What you will learn from this user's guide

This user's guide explains how to install, configure, and use the CIO-DAS48-I board so that you get the most out of its analog current input features. This user's guide also refers you to related documents available on our web site, and to technical support resources.

### Conventions in this user's guide

The following conventions are used in this manual to convey special information:

#### **For more information on ...**

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

**Caution!** Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such as those assigned to registers, bit settings, etc.

**bold text** **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:  
1. Insert the disk or CD and click the **OK** button.

*italic text* *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:  
The InstaCal installation procedure is explained in the *Quick Start Guide*.  
*Never* touch the exposed pins or circuit connections on the board.

### Where to find more information

For additional information relevant to the operation of your hardware, refer to the *Documents* subdirectory where you installed the MCC DAQ software (C:\Program Files\Measurement Computing\DAQ by default), or search for your device on our website at [www.mccdaq.com](http://www.mccdaq.com).

If you need to program at the register level in your application, refer to the *Register Map for the CIO-DAS48-PGA and CIO-DAS48-I*. This document is available on our website at [www.mccdaq.com/registermaps/RegMapCIO-DAS48-PGA-I.pdf](http://www.mccdaq.com/registermaps/RegMapCIO-DAS48-PGA-I.pdf).

# Introducing the CIO-DAS48-I

## Overview: CIO-DAS48-I features

The CIO-DAS48-I is a CIO-DAS48-PGA board with six SIP resistors installed. These resistors convert the voltage inputs on the CIO-DAS48-PGA to current inputs.

The CIO-DAS48-I provides 24 current inputs. The input mode is switch-selectable. Input ranges are software-selectable for 4-20 mA, 2-10 mA, 1-5 mA, or 0.5-2.5 mA.

A DC/DC converter supplies stable  $\pm 15$  V power to the analog circuitry. It is possible to construct the board without the DC/DC converter. This reduces the cost but limits the ranges of analog inputs. It is available with orders of 10 or more units. You can enable a wait state generator with an on-board jumper.

## Software features

For information on the features of InstaCal and the other software included with your CIO-DAS48-I, refer to the *Quick Start Guide* that shipped with your device.

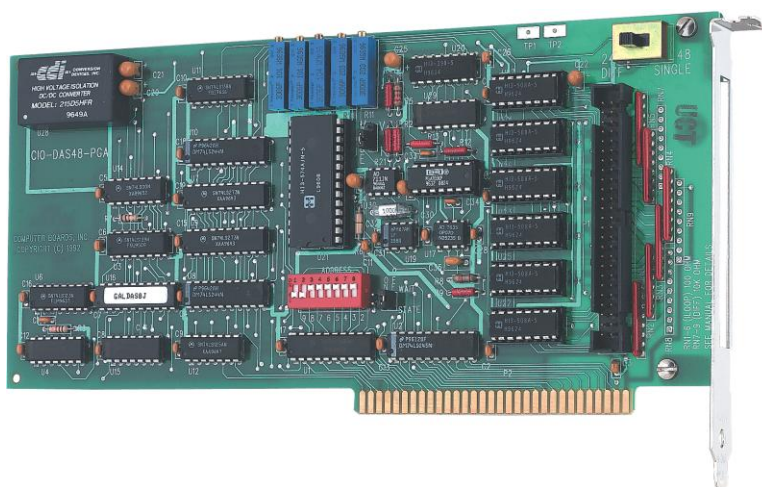
# Installing the CIO-DAS48-I

## What comes with your CIO-DAS48-I shipment?

The following items are shipped with the CIO-DAS48-I.

### Hardware

- CIO-DAS48-I (ships as a CIO-DAS48-PGA with six SIP resistors installed near the 50-pin connector)



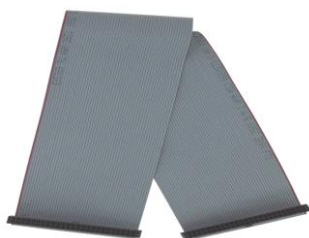
## Additional documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide* (available in PDF at [www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf)). This booklet supplies a brief description of the software you received with your CIO-DAS48-I and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

## Optional components

You can also order the following MCC product to use with your CIO-DAS48-I.

- C50FF-x cable



- Signal termination and conditioning accessories

MCC provides signal conditioning and termination products for use with the CIO-DAS48-I. Refer to [Field wiring, signal termination, and conditioning](#) on page 12 for a complete list of compatible accessory products.



## Unpacking the CIO-DAS48-I

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the CIO-DAS48-I from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

If any components are missing or damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail:

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: [techsupport@mccdaq.com](mailto:techsupport@mccdaq.com)

## Installing the software

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at [www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf).

## Configuring the CIO-DAS48-I

The CIO-DAS48-I has a base address switch, an input mode switch, an input type jumper, and a wait state jumper which you must set before installing the board in your computer.

The InstaCal calibration and test program included with the CIO-DAS48-I will show you how to set the switches and jumpers. Run InstaCal before you open your computer and install the board. The CIO-DAS48-I is shipped with the factory-default settings listed below.

Factory-configured default settings

Switch/jumper description	Default setting
Base address DIP switch	300h (768 decimal)
Wait State jumper	Off (disabled)
DIFF/SINGLE (input mode) switch	"24 DIFF" position – do not change
Mode V-I jumper (voltage or current type)	"I" (current) – do not change

Before installing the CIO-DAS48-I, verify that the board is configured with the settings that you want. Review the following information to change the default configuration of a jumper or switch on the CIO-DAS48-I board.

### Base address

Before you install the CIO-DAS48-I in your computer, set the base address by using the dip switch labeled **ADDRESS** located on the board. The easiest way to set the base address switch is to let InstaCal show you the correct settings. However, if are already familiar with setting ISA base addresses, you may use the base address switch description below to guide your base address selection.

Unless there is already another board in your system using address 300 hex (768 decimal), leave the switches as they are set at the factory. The example shown in Figure 1 shows the settings for the factory-default base address of 300 hex.

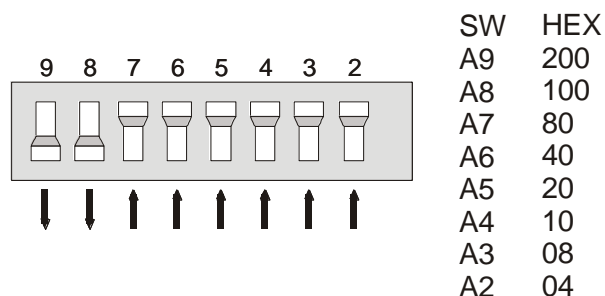


Figure 1. Base address switches

In the default configuration shown in Figure 1, addresses 9 and 8 are DOWN, and all others are UP. Address 9 = 200 hex (512 decimal) and address 8 = 100 hex (256 decimal); when added together they equal 300 hex (768 decimal).

**Disregard the numbers printed on the switch**

When setting the base address, refer to the numbers printed in white on the printed circuit board.

## Wait state

Enable the wait state jumper if you have a computer with an I/O bus transfer rate which is too fast for the CIO-DAS48-I, or if the board fails sporadically in random ways.

To enable the wait state, set the jumper to the ON position. This jumper is OFF by default. Enabling the wait state causes the personal computer's bus transfer rate to slow down whenever CIO-DAS48-I is written to or read from. This jumper is shown in Figure 2 configured for OFF (wait state is disabled).

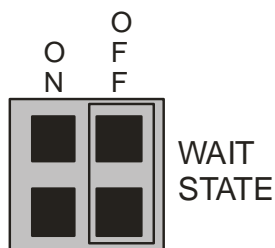


Figure 2. Wait state jumper

## Input type (V-I)

The jumper labeled **MODE V-I** sets the input type to either voltage (V) or current (I). The CIO-DAS48-I is configured for current inputs, so set this jumper for **I** (Figure 3). Move the jumper from **V** to **I** *only* if you have installed the CIO-DAS48-ISIP kit.

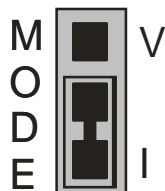


Figure 3. Input type jumper

## Input mode (DIFF/SINGLE)

The differential/single ended mode switch (Figure 4) sets board logic for 48 single-ended or 24 differential mode. The CIO-DAS48-I is configured for 24 current measurements, so set this switch for **24 DIFF**.



Figure 4. Input mode switch

## Installing the CIO-DAS48-I

After you configure the board's switches and jumpers, you can install the CIO-DAS48-I into your computer. To install your board, follow the steps below.

### Install the MCC DAQ software before you install your board

The driver needed to run your board is installed with the MCC DAQ software. Therefore, you need to install the MCC DAQ software before you install your board. Refer to the *Quick Start Guide* for instructions on installing the software.

1. Turn your computer off, open it up, and insert your board into an available ISA slot.
2. Close your computer and turn it on.
3. To test your installation and configure your board, run the InstaCal utility you installed in the previous section. Refer to the *Quick Start Guide* that came with your board [www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf) for information on how to initially set up and load *InstaCal*.

## Connecting the board for I/O operations

### Connectors, cables – main I/O connector

The table below lists the board connector, applicable cables, and compatible accessory products.

Board connector, cables, and accessory equipment

Connector type	50-pin header connector
Compatible cable	C50FF-x
Compatible accessory products with the C50FF-x cable	CIO-MINI50 CIO-SPADE50

### Information on signal connections

General information regarding signal connection and configuration is available in the *Guide to Signal Connections* (available at [www.mccdaq.com/signals/signals.pdf](http://www.mccdaq.com/signals/signals.pdf)).

## Pinout – main I/O connector

The CIO-DAS48-I I/O connector is a standard 50-pin header connector that is accessible from the rear of the computer through the expansion backplate.

LLGND	50	●	●	49	LLGND
CH 23 IN LO	48	●	●	47	CH 23 IN HI
CH 22 IN LO	46	●	●	45	CH 22 IN HI
CH 21 IN LO	44	●	●	43	CH 21 IN HI
CH 20 IN LO	42	●	●	41	CH 20 IN HI
CH 19 IN LO	40	●	●	39	CH 19 IN HI
CH 18 IN LO	38	●	●	37	CH 18 IN HI
CH 17 IN LO	36	●	●	35	CH 17 IN HI
CH 16 IN LO	34	●	●	33	CH 16 IN HI
CH 15 IN LO	32	●	●	31	CH 15 IN HI
CH 14 IN LO	30	●	●	29	CH 14 IN HI
CH 13 IN LO	28	●	●	27	CH 13 IN HI
CH 12 IN LO	26	●	●	25	CH 12 IN HI
CH 11 IN LO	24	●	●	23	CH 11 IN HI
CH 10 IN LO	22	●	●	21	CH 10 IN HI
CH 9 IN LO	20	●	●	19	CH 9 IN HI
CH 8 IN LO	18	●	●	17	CH 8 IN HI
CH 7 IN LO	16	●	●	15	CH 7 IN HI
CH 6 IN LO	14	●	●	13	CH 6 IN HI
CH 5 IN LO	12	●	●	11	CH 5 IN HI
CH 4 IN LO	10	●	●	9	CH 4 IN HI
CH 3 IN LO	8	●	●	7	CH 3 IN HI
CH 2 IN LO	6	●	●	5	CH 2 IN HI
CH 1 IN LO	4	●	●	3	CH 1 IN HI
CH 0 IN LO	2	●	●	1	CH 0 IN HI

Figure 5. I/O connector pin-out

Current connections are made between CH# HI and CH# LOW. The positive terminal of the current to be measured must be connected to CH# HI (refer to Current loop measurements on page 13).

## Cabling

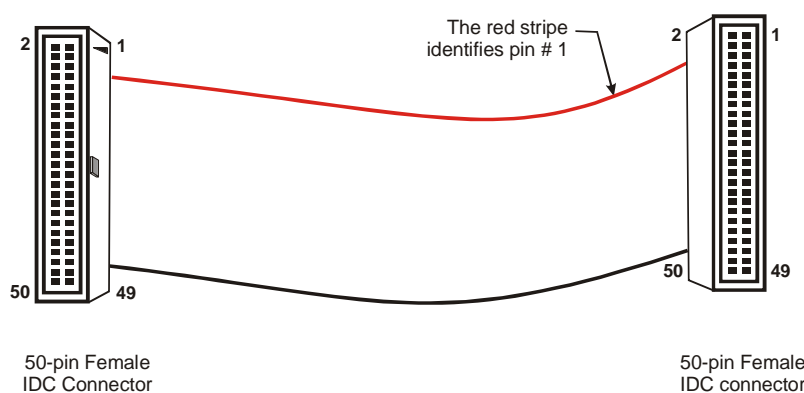


Figure 6. C50FF-x cable

## Field wiring, signal termination, and conditioning

You can use the following cabling, screw termination, and signal conditioning products with the CIO-DAS48-I.

- CIO-MINI50 – 50-pin screw terminal board
- CIO-SPADE50 — 16" X 4" termination panel which mates with both 37-pin and 50-pin connectors.

Details on these products are available on our web site at [www.mccdaq.com/products/screw\\_terminal\\_bnc.aspx](http://www.mccdaq.com/products/screw_terminal_bnc.aspx).

## Functional Details

### Current loop measurements

The CIO-DAS48-I is configured for current loop measurements in the 4 to 20 mA range. Ranges of 2 to 10 mA, 1 to 5 mA and 0.5 to 2.5 mA are also possible but are less commonly used. A typical current loop system uses 24V to power the current loop. Current output devices are available in two-wire and three-wire configurations. Use the figures below as guides in connecting devices to the CIO-DAS48-I.

#### Two-wire devices

The "floating device" configuration is required for most systems using two-wire devices due to the restriction on common mode range for the CIO-DAS48-I. If the power supply were connected to the CIO-DAS48-I input, as in a "grounded device" system, the common mode input range spec would be violated and inaccurate measurements would result.

Figure 7 shows a "floating device" configuration for a two-wire, 4 to 20 mA device. This is the correct configuration that ensures that the common mode range input specification is not violated.

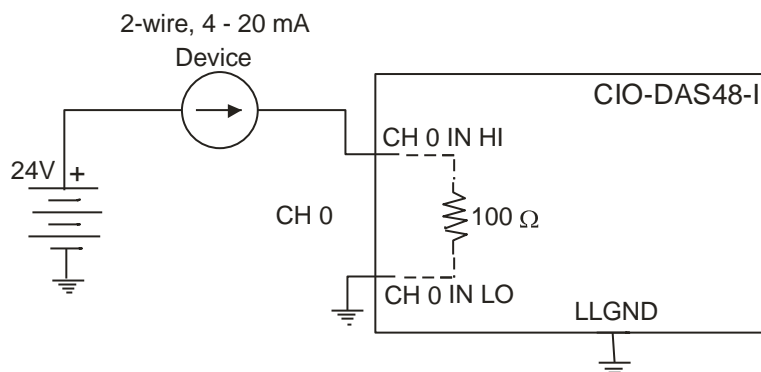


Figure 7. Floating device configuration

Figure 8 below shows a "grounded device" configuration for a two-wire, 4 to 20 mA device. DO NOT USE this configuration — the 24 V supply connection, direct to the input, violates the common mode range input specification of the CIO-DAS48-I.

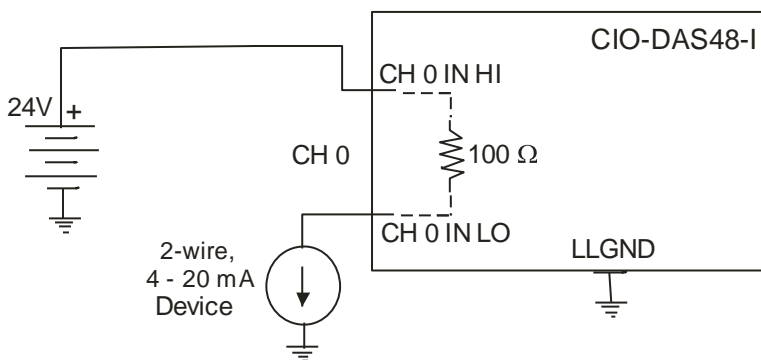


Figure 8. Grounded device configuration – Caution – DO NOT USE!

## Three-wire devices

Figure 9 shows a three-wire, 4 to 20 mA device connected to channel 0 of the CIO-DAS48-I. Three-wire devices will typically specify the maximum load resistance for the current output. The input resistance of the CIO-DAS48-I is  $100\ \Omega$  (determined by the CIO-DAS48-ISIP installed). Add this value to any other load resistances in the loop. Typically, the maximum resistance specified for three-wire devices is on the order of  $1\ \text{k}\Omega$ .

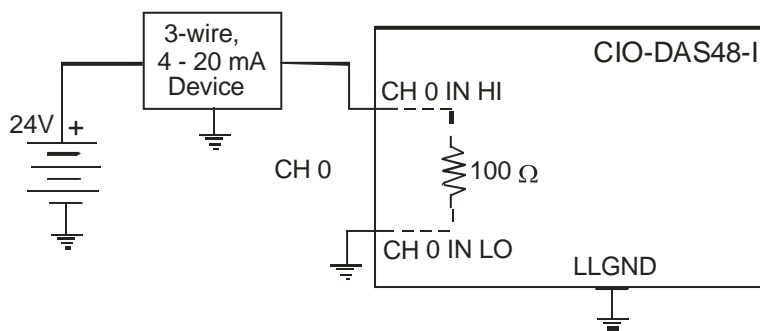


Figure 9. Connecting a three-wire device

# Specifications

Typical for 25°C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

## Analog input

Table 1. Analog input specifications

Parameter	Specification
A/D converter type	AD574
Resolution	12 bits
Number of channels	24
Input type	Current input
Input ranges	4 to 20 mA, 2 to 10 mA, 1 to 5 mA and 0.5 to 2.5 mA, software selectable
Polarity	Unipolar/Bipolar, software selectable
A/D pacing	Software polled
Data transfer	Software polled
A/D conversion time	25 $\mu$ s
Throughput	20 kS/s, PC dependent
Accuracy	$\pm 0.01\%$ of reading $\pm 1$ LSB
Differential Linearity error	$\pm 1$ LSB
Integral Linearity error	$\pm 0.5$ LSB
No missing codes guaranteed	12 bits
Gain drift (A/D specs)	$\pm 25$ ppm/°C
Zero drift (A/D specs)	$\pm 10$ $\mu$ V/°C
Common mode range	$\pm 10$ V
CMRR	72 dB
Input leakage current (@ 25 °C)	100 nA
Input impedance	100 Ohms
Absolute maximum input voltage	$\pm 35$ V
Noise distribution (Rate = 1-10 kHz, Average % +/- 2 bins, Average % +/- 1 bin, Average # bins)	
4 to 20 mA	100% / 100% / 3 bins
2 to 10 mA	100% / 98.8% / 4 bins
1 to 5 mA	100% / 96.8% / 4 bins
0.5 to 2.5 mA	100% / 98.2% / 5 bins

## Power consumption

Table 2. Power consumption specifications

+5 V	620 mA typical, 800 mA max
------	----------------------------

## Environmental

Table 3. Environmental specifications

Operating temperature range	0 to 50 °C
Storage temperature range	-20 to 70 °C
Humidity	0 to 90% non-condensing

## Main connector and pin out

Table 4. Main connector specifications

Connector type	50-pin D type connector
Compatible cable	C50FF-x
Compatible accessory products with the C50FF-x cable	CIO-MINI50 CIO-SPADE50

Table 5. Connector pin out

Pin	Signal name	Pin	Signal name
50	LLGND	49	LLGND
48	CH 23 IN LO	47	CH 23 IN HI
46	CH 22 IN LO	45	CH 22 IN HI
44	CH 21 IN LO	43	CH 21 IN HI
42	CH 20 IN LO	41	CH 20 IN HI
40	CH 19 IN LO	39	CH 19 IN HI
38	CH 18 IN LO	37	CH 18 IN HI
36	CH 17 IN LO	35	CH 17 IN HI
34	CH 16 IN LO	33	CH 16 IN HI
32	CH 15 IN LO	31	CH 15 IN HI
30	CH 14 IN LO	29	CH 14 IN HI
28	CH 13 IN LO	27	CH 13 IN HI
26	CH 12 IN LO	25	CH 12 IN HI
24	CH 11 IN LO	23	CH 11 IN HI
22	CH 10 IN LO	21	CH 10 IN HI
20	CH 9 IN LO	19	CH 9 IN HI
18	CH 8 IN LO	17	CH 8 IN HI
16	CH 7 IN LO	15	CH 7 IN HI
14	CH 6 IN LO	13	CH 6 IN HI
12	CH 5 IN LO	11	CH 5 IN HI
10	CH 4 IN LO	9	CH 4 IN HI
8	CH 3 IN LO	7	CH 3 IN HI
6	CH 2 IN LO	5	CH 2 IN HI
4	CH 1 IN LO	3	CH 1 IN HI
2	CH 0 IN LO	1	CH 0 IN HI



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