Cart 400 Overview and system description

Content

1 Introduction

This document provides an overview of the operation of the Malå GeoScience "Cart 400" system. Pulse generator circuit diagrams as well as module internal photographs are contained in separate documents.

2 Overview

The *CART Imaging System* is the first practical system for making continuous 3D radar images ("radar tomography") of the subsurface on a large scale. The radar in the standard 400 MHz *CART* system is a down-looking, ultra-wideband impulse radar, with a pulse spectrum in the bandwidth from about 100 to 650 MHz. The *CART* uses 9 transmitters and 8 receivers in two parallel rows to create its unique 16-channel GPR array. Spacing between channels in the normal configuration is about 3.25 inches, so the ground "swath" covered by the array is about 4.35 ft wide (1.3 m). The system can fire and collect all 16 channels once every 4 inches (measured along the direction of motion), while moving at speeds up to 1500 ft/hr (0.5 km/hr).

Cart 400 is an ultra-wide band system intended for utility detection and non destructive testing. In use the system performs time domain reflectometry by radiating a radio frequency impulse with a repetition rate of 100kHz from a transmitting dipole. Transitions between materials exhibiting different wave impedances through which the electromagnetic wave travels cause the wave to be reflected. These reflections are received by the receiving dipole and sampled inside the antenna units. Results may be presented in real time on the PC connected to the system and recorded on a hard disk on the same PC for later analysis.

The Cart 400 consists off a fibreglass case with 9 transmitters and 8 receivers and a digital supporting unit that controls firing of transmitters and receivers. It also collects data and send it to a lap-top for further processing.

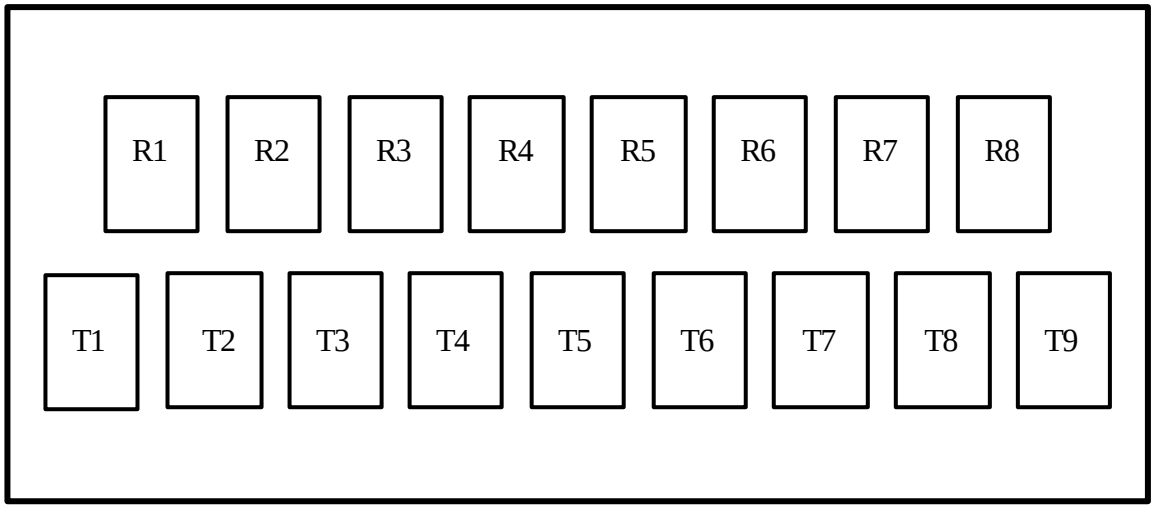

Figure 1. Schematic overview Cart 400 antenna setup.

UWB transducer: The shielded transducer comprises, an impulse generator and an antenna element. The pulse generator board is mounted directly on the antenna and it's surrounded by absorbents and a metal shield. It's also stuffed with absorbents between the outer aluminum housing ant the inner metal shield. There is also absorbents on the outside of the outer shield. 12 V DC power and control signal is fed to the transducer via a voltage converter unit, mounted at the top of the transducer. Control signal, +/-8 V and 630 V are then fed to the transducer via a D-sub connector. Inside the transducer, in a shielded compartment there is a PCB with current limiting resistors and connectors to the impulse generator.

Power supply: The Cart 400 system is powered from a 12 V Lead/acid battery.

3 Technical Description of Cart 400 transducer

General

A block diagram of a shielded transducer is shown in figure 2 below.

The transducer housing is made of aluminum. It's made like a box, open on one side(bottom), where the antenna and impulse generator is placed. In the top of the box there is a small compartment in which the PCB with current limiting resistors and connectors to the impulse generator is placed. Power and control signal is fed to the impulse generator trough cables and a coax through this PCB.
The antenna and impulse generator are surrounded with an extra metal shield. Both inner and outer shield is stuffed with absorbents. No rf-signals leave the transducer trough connectors.

Operation

In the transmitter, high voltage DC-power, transmitter control signal as well as ground reference are fed to the impulse generator on top of the antenna element. The impulse created is fed to the antenna element. The antenna element is situated on an electromagnetic absorbing material and resistively loaded at its endpoints.

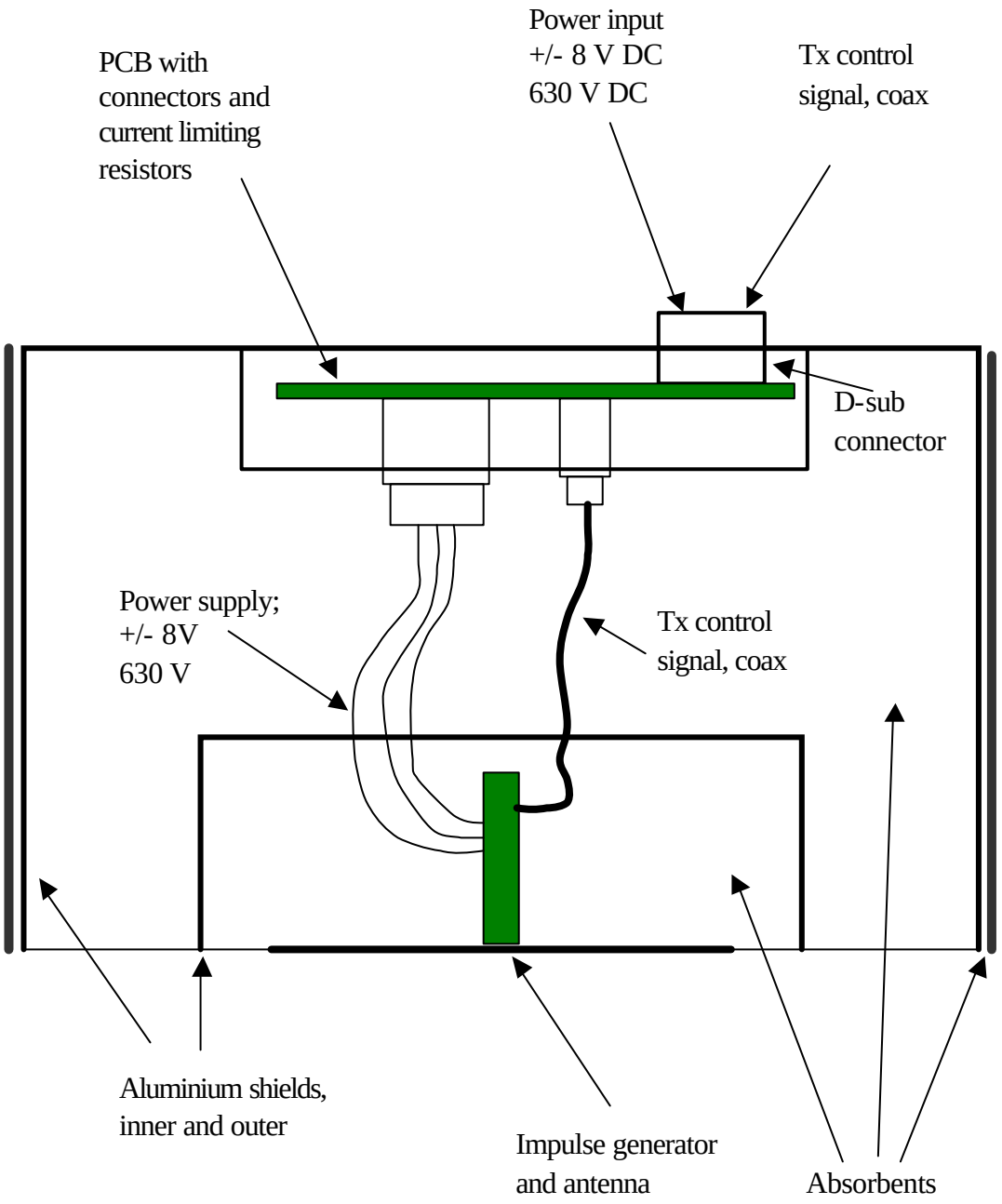

Figure 1. Schematic overview of the Cart 400 transmitter unit.