



# SunTech<sup>®</sup> *CT40*<sup>™</sup>

VITAL SIGNS



## Spot-check Vital Signs Device

### HL7 Messaging Specifications

## Changes

This manual is identified as Part number: 80-0073-00-MO. The most recent is available for download from the SunTech Medical website. Should you notice errors or omissions in this manual, please notify us at:

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## User Responsibility

Your SunTech CT40 is designed to perform in conformity with the description contained in this operation manual and accompanying labels and inserts, when assembled, operated, maintained and repaired in accordance with the instructions provided.

Further, the user of the device bears sole responsibility for any malfunction that results from improper use, faulty maintenance, improper repair, damage or alteration by anyone other than SunTech Medical or authorized service personnel.

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## Welcome to the SunTech CT40

Thank you for choosing this SunTech CT40 for accurate spot checking of vital signs.

The SunTech CT40 is designed to be very easy and efficient to use. The mobile device provides a lot of functionality in a compact, cost-effective package. The device can perform automatic blood pressure checks, including averaging of multiple blood pressure readings. It also offers an option to use a stethoscope for traditional auscultatory blood pressure measurement. The SunTech CT40 offers robust memory and also can connect to your EMR system. In addition, there are options for pulse oximetry and temperature measurement. The device can easily connect to a barcode scanner or printer.

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# 1. Introduction

## 1.1 Intention

This document describes the HL7 interface of the SunTech CT40 device for the interchange of data. This document is for the person who integrates the SunTech CT40 device with an Electronic Medical Record (EMR) system.

## 1.2 Scope

This document contains an overview of the IHE profiles that are implemented in the CT40, the steps within the HL7 communication, the message types used, the data provided by the device, and the expected response from the communication partner. An introduction to IHE and HL7 can be found at the web sites <http://ihe.net/> and <https://www.hl7.org/> and are not part of this document.

## 1.3 EMR Setup

Instructions on how to configure the SunTech CT40 to communicate with an EMR system can be found in the SunTech CT40 Advanced Configuration Application Guide (p/n 80-0072-00-MO) which can be downloaded from the SunTech web site at : <http://suntechmed.com/bp-products/blood-pressure-w-vitals/suntech-ct40#documents>

## 2. Usage of IHE Profiles

The SunTech CT40 has implemented communications profiles from Integrating the Healthcare Enterprise (IHE), a consortium of healthcare and medical device professionals dedicated to improving the way the healthcare information systems share information. The IHE Integration Statement for the CT40 can be downloaded from SunTech's web site <http://www.suntechmed.com/support/document-library/category/63-suntech-ct40>.

The IHE profiles implemented by the SunTech CT40 are:

<b>IHE Domain</b>	<b>Integration Profile</b>	<b>Actor</b>
<a href="#">IT Infrastructure (ITI)</a>	<a href="#">Consistent Time (CT)</a>	Time Client
<a href="#">Patient Care Devices (PCD)</a>	<a href="#">Device Enterprise Communication (DEC)</a>	Device Observation Reporter (DOR)
<a href="#">IT Infrastructure (ITI)</a>	<a href="#">Patient Demographics Query (PDQ)</a>	Patient Demographics Consumer (PDC)

*NOTE : In order to connect successfully to the SunTech CT40, the EMR must support at least two HL7 versions: V2.5 and V2.6*



## 3. Patient Identification

Within the EMR system the identification of a patient is based on the alphanumeric identifier assigned to a patient. The identifier must fulfill the following requirements :

- It must be unique for the patient
- It must be sufficient to identify a patient (sometimes called a "Patient ID only")

By using a Patient ID, it is not necessary to provide patient demographic information such as first name, last name or date of birth in addition to the patient ID in order to properly identify a patient.

## 4. Information Flow

### 4.1 Overview

The HL7 workflow starts with input of the patient ID by the user. This is done by reading the Patient ID with an attached barcode scanner (SunTech p/n 98-0257-00). The device stores exactly one Patient ID. A re-read of a Patient ID overwrites the value recorded previously.


If the SunTech CT40 device has been configured to connect to an EMR system (see Chapter 5 of the SunTech CT40 Advanced Configuration Application Guide, p/n 80-0072-00-MO), the Patient ID will be validated. To do this the device sends the Patient ID (PDQ) to the EMR. The EMR then sends back a message whether it recognizes the Patient ID as valid or not.

The workflow stops in the following cases:

- The patient ID is unknown.
- The patient ID is imprecise and matches multiple patients.

The scanned Patient ID will be displayed on the LCD if it was successfully validated. If the Patient ID cannot be validated, an error code will be displayed on the LCD. For a list of error codes associated with Patient ID, see [8.1 Patient ID Error Codes](#) for more information. Once a Patient ID has been scanned and validated the user can:

- Measure a patient's vital sign(s) or
- The vital sign(s) currently selected is (are) used for the next steps.

When the user presses the Memory button , the vital signs HL7 data transfer between the device and the EMR is triggered, and the vital signs are also stored in the CT40 memory.

### 4.2 Message Retry

In case the connection to the EMR fails, the request cannot be sent, or the response is missing, the device will try to re-send the message. An Error code will be displayed on the LCD to indicate the type of issue encountered. Please see [8.2 Vitals Measurements Error Codes](#) for more information. The following retry parameters can be customized during EMR setup (see Chapter 5 of the SunTech CT40 Advanced Configuration Application Guide, p/n 80-0072-00-MO):

- Timeout: Time in seconds before a connection attempt to the EMR server is declared a "Timeout"
- Retries: Number of attempts to connect to the EMR server and send a reading.
- Retry interval: Time in seconds between connection attempts to the EMR server.





## 5. Time Synchronization

To avoid moving dates and times between HL7 systems, the clocks of the communication partners should be synchronized. To achieve this, the device implements a client of the Network Time Protocol (NTP). The NTP server parameters, as well as timezone information can be customized during EMR setup (see Chapter 5 of the SunTech CT40 Advanced Configuration Application Guide, p/n 80-0072-00-MO):

## 6. Verification of Patient ID

### 6.1 Overview

To verify a Patient ID, the SunTech CT40 uses the IT Infrastructure (ITI) domain / Patient Demographics Query (PDQ) IHE profile. In this scenario the device is the Patient Demographics Consumer whereas the EMR is the Patient Demographics Supplier. The device queries the EMR for a given patient ID, and the EMR sends a response whether or not the Patient ID matches any of the known IDs in the database.

The used messages are:

- Device sends a Patient Demographics Query (QBP^Q22).
- EMR responses with a Patient Demographics Response (RSP^K22).

*NOTE: This profile is based on HL7 version 2.5.*

### 6.2 Request from Device to EMR

A Patient Demographics Query (QBP^Q22) is used to request whether or not a Patient ID is valid.

#### 6.2.1 Message Structure and Segments

The table below gives an overview of the Patient Demographics Query messaging.

*Note: Segment DSC is optional and not used in this use case.*

QBP	Query by Parameter	Chapter in HL7 2.5
MSH	Message Header	2
QPD	Query Parameter Definition	5
RCP	Response Control Parameter	5
[DSC]	Continuation Pointer	2

Table 1

#### 6.2.2 Example

```
MSH|^~\&|PAT_DEVICE_SMI|SMI|PIX_X_REF_MGR_Vision|VisionWare|20150423131601+0200||QBP^Q22^QBP_Q21|IFFugYp8cYhPek5fPdPn|P|2.5||AL|NE|||ITI-21^IHE
QPD|IHE PDQ Query|PDQ104211|@PID.3.1^IHERED-1032~@PID.3.4.1^IHERED~@PID.3.4.2^1.3.6.1.4.1.21367.13.20.1000~@PID.3.4.3^ISO
RCP|I|1^RD
```

- The device requests the EMR application "PIX\_X\_REF\_MGR\_Vision" (MSH-5), facility "VisionWare" (MSH-6).
- An acknowledgement is always expected by (MSH-15 = "AL").
- The patient ID to verify is "IHERED-1032" (QPD-3.1.2) at domain "IHERED" (QPD-3.2.2).
- An immediate response is requested (RCP-1 = "1") and must contain exactly one hit (RCP-2.1 = "1") of type record (RCP-2.2 = "RD").
- Unique message id is "IFFugYp8cYhPek5fPdPn".

## 6.3 Response from EMR to Device

A Patient Demographics Response (RSP^K22) is expected by the device. Within the response exactly one segment of type PID must be returned. The workflow stops in all other cases.

### 6.3.1 Message Structure and Segments

The table below gives an overview of the Patient Demographics Response messaging:

RSP	Segment Pattern Response	Chapter in HL7 2.5
MSH	Message Header	2
MSA	Message Acknowledgement	2
[ {ERR} ]	Error	2
QAK	Query Acknowledgement	5
QPD	Query Parameter Definition	5
[ { PID	Patient Identification	3
[ PD1 ]		
[ QRI ] }	Query Response Instance	5
[ DSC ]	Continuation Pointer	2

Table 2

### 6.3.2 Example

```
MSH|^~\&|MultiVue|VisionWare|PAT_DEVICE_SMI|SMI|20150423141558||RSP^K22^RSP_K21|817a4e81-9a8c-4eb5-b|T|2.5
MSA|AA|IFFugYp8cYhPek5fPdPn
QAK|PDQ104211|OK
QPD|IHE PDQ Query|PDQ104211|@PID.3.1^IHERED-1032~@PID.3.4.1^IHERED~@PID.3.4.2^1.3.6.1.4.1.21367.13.20.1000~@PID.3.4.3^ISO
PID|1||IHERED-1032^^^IHERED&1.3.6.1.4.1.21367.13.20.1000&ISO~IHEGREEN-1032^^^IHEGREEN&1.3.6.1.4.1.21367.13.20.2000&ISO~IHEBLUE-1032^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO~IHEFACILITY-1032^^^IHEFACILITY&1.3.6.1.4.1.21367.3000.1.6&ISO
|MOORE^CHIP^^^^^L|^^^^^L|19380224|M||10 PINETREE^^WEBSTER^^63119
```

- Response from EMR application “MultiVue” (MSH-5), facility “VisionWare” (MSH-6). The application had accepted the request (MSA-1 = “AA”). The query response status is “OK” (QAK-2) and exactly one segment of type “PID” was returned.
- The Patient Identifier List (PID-3) contains four entries, which belong to the same patient:
  - Patient ID “IHERED-1032” in domain “IHERED”
  - Patient ID “IHEGREEN-1032” in domain “IHEGREEN”
  - Patient ID “IHEBLUE-1032” in domain “IHEBLUE”
  - Patient ID “IHEFACILITY-1032” in domain “IHEFACILITY”
- The name of the patient is “Chip Moore” (PID-5).
- Unique message id is “IFFugYp8cYhPek5fPdPn”

## 7. Sending Vitals Measurements to EMR

### 7.1 Overview

The send vital signs measurements to an EMR, the SunTech CT40 uses the Patient Care Device (PCD) domain / Device Enterprise Communication (DEC) IHE profile. In this scenario the device is the Device Observation Reporter (DOR) whereas the EMR is the Device Observation Consumer (DOC). The device sends vital signs measurements together with a verified Patient ID to the EMR. The EMR sends a response indicating whether or not the data could be processed successfully.

The messages used are:

- Device sends a PCD-01 Communicate PCD Data (ORU^R01^ORU\_R01) as a request
- EMR responds with a simple general acknowledgment (ACK)

This profile is based on HL7 version 2.6.

### 7.2 Request from Device to EMR

A PCD-01 Communicate PCD Data (ORU^R01^ORU\_R01) is used to send the vitals measurements.

#### 7.2.1 Message Structure and Segments

The table below gives an overview of the Device Observation Reporter messaging. See the given chapters in HL7 2.6 documentation for further details.

Segment	Meaning	Usage	Card	Chapter in HL7 2.6
MSH	Message Header	R		2
[[SFT]]	Software Segment	X	[0..0]	2
{	--- PATIENT_RESULT begin			
[	--- PATIENT begin			
PID	Patient Identification	R	[1..1]	3
[PD1]	Additional Demographics	X	[0..0]	3
..[[NTE]]	Notes and Comments	X	[0 0]	2
..[[NK1]]	Next of Kin/Associated Parties	X	[0..0]	3
[	--- VISIT begin			
PV1	Patient Visit	O	[0..1]	3
[PV2]	Patient Visit – Additional Info	R	[0..0]	3

Segment	Meaning	Usage	Card	Chapter in HL7 2.6
]	--- VISIT end			
]	--- PATIENT end {---ORDER_OBSERVATION			
{	---ORDER_OBSERVATION begin			
[ORC]	Order Common	O	[0..1]	4
OBR	Observation Request	R	[1..1]	7
[(NTE)]	Notes and Comments	O	[0..1]	2
{	--- TIMING_QTY begin			
TQ1	Timing/Quantity	O	[0..1]	4
[(TQ2)]	Timing/Quantity Order Sequence	X		4
}	--- TIMING_QTY end			
[CTD]	Contact Data	X	[0..0]	11
{	--- OBSERVATION begin			
OBX	Observation Result	R	[1..1]	7
[(NTE)]	Notes and comments			2
}}	--- OBSERVATION end			
[(FT1)]	Financial Transaction	X	[0..0]	6
[(CTI)]	Clinical Trial Identification	X	[0..0]	7
{	--- SPECIMEN begin			
SPM	Specimen	X	[0..0]	7
[(OBX)]	Observation related to Specimen	X	[0..0]	7
}	--- SPECIMEN end			
}	--- ORDER_OBSERVATION end			

Segment	Meaning	Usage	Card	Chapter in HL7 2.6
}	--- PATIENT_RESULT end			
[DSC]	Continuation Pointer	X	[0..0]	2

Table 3

### 7.2.2 Example 1

```
MSH|^~\&|PAT_DEVICE_SMI|SMI|ADT_Openxtrem_2015|Openxtrem|20150423155615+0200||ORU^R01^
ORU_R01|0F08fg7jPIh0F12WBDMzVba|P|2.6||AL|NE||||IHE_PCD_001^IHE_PCD^1.3.6.1.4.1.1937
6.1.6.1.1.1^ISO
PID||||2010002^^^DUMMY&1.2.3.4.5&ISO^PI||Smith^Charles^^^^L||19610201|||||||123456
789^^^IHE^AN
PV1||I
OBR|1|OBR|PAT_DEVICE_SMI0F08vvhz4tRI6WkaPEMi8QYkkUC^SMI^www.suntechmed.com^URI|6174600
7^Taking patient vital signs^SCT||20150423165614+0200
NTE|1||Clinician initiated vitals reading
OBX|2||528391^MDC_DEV_SPEC_PROFILE_BP^MDC|1.0.0.0|||||X|||||PAT_DEVICE_SMI^serial
^SMI^www.suntechmed.com^URI
OBX|3|NM|150456^MDC_PULS_OXIM_SAT_O2^MDC|1.0.0.1|80|262688^MDC_DIM_PERCENT^MDC||||F||
|20150423165614+0200||AMEAS^auto-measurement^MDC
```

- Request from device to store vital parameter for patient entity with patient ID “2010002” (PID-3)
- Data are provided by “PAT\_DEVICE\_SMI0F08vvhz4tRI6WkaPEMi8QYkkUC”(OBR-3.1)
- Provided vital parameter is SpO<sub>2</sub> of 80 (OBX-5) percent (OBX-6), measured by pulse oximeter (OBX-3 = “150456^MDC\_PULS\_OXIM\_SAT\_O2^MDC”)

### 7.2.3 Example 2

```
MSH|^~\&|ENOVACOM|ENOVACOM|EPC|ENOVACOM|20150424105952.990||ORU^R01^ORU_R01|37801|P|2.
6||AL|NE||||IHE_PCD_001^IHE_PCD^1.3.6.1.4.1.19376.1.6.1.1.1^ISO
PID||HO2009001^^^DUMMY&1.2.3.4.5&ISO^PI||Hon^Amy^^^^L||19610301|F||5615 S Palo Verd
e^^Tucson^^85706^^H|||||123456788^^^IHE^AN
PV1||I|HO 3 West ICU^10^1|||||||001500050^^^IHE^VN
OBR|1|1429865992991^ENOVACOM|1429865992991^ENOVACOM|754050^InClinic^MDC||201504241059
52.878|||||F|||||^HO 3 West ICU
OBX|1||69837^MDC_DEV_METER_PHYSIO_MULTI_PARAM_MDS^MDC|1.0.0.0|||||X
OBX|2|NM|149546^MDC_PULS_RATE_NON_INV^MDC|1.1.1.1|68|264864^MDC_DIM_BEAT_PER_MIN^MDC|
||F|||||demo1^ENOVACOM-DEMO^Enovacom
OBX|3|NM|150456^MDC_PULS_OXIM_SAT_O2^MDC|1.1.1.2|99|262688^MDC_DIM_PERCENT^MDC||||F||
||||demo1^ENOVACOM-DEMO^Enovacom
OBX|4|NM|150021^MDC_PRESS_BLD_NONINV_SYS^MDC|1.1.1.3|11|266016^MDC_DIM_MMHG^MDC||||F||
||||demo1^ENOVACOM-DEMO^Enovacom
OBX|5|NM|150022^MDC_PRESS_BLD_NONINV_DIA^MDC|1.1.1.4|858|266016^MDC_DIM_MMHG^MDC||||F||
||||demo1^ENOVACOM-DEMO^Enovacom
OBX|6|NM|150023^MDC_PRESS_BLD_NONINV_MEAN^MDC|1.1.1.5|210|266016^MDC_DIM_MMHG^MDC||||F||
||||demo1^ENOVACOM-DEMO^Enovacom
```

- Request from device to store vital parameter for patient entity with patient ID “2010002” (PID-3)
- Data are provided by “PAT\_DEVICE\_SMI0F08vvhz4tRI6WkaPEMi8QYkkUC” (OBR-3.1)
- Provided vital parameter are:
  - o Pulse rate
  - o SpO<sub>2</sub>
  - o Blood pressure systolic
  - o Blood pressure diastolic
  - o Mean blood pressure

## 7.3 Response from EMR to Device

A simple Acknowledgment Message (ACK\_R01\_ACK) is sent from the EMR to the device.

### 7.3.1 Message Structure and Segments

The table below gives an overview of the Device Observation Consumer messaging. See the given chapters in HL7 2.6 documentation for further details.

ACK^varies^ACK	General Acknowledgment	Chapter in HL7 2.6
MSH	Message Header	2
[[ SFT ]]	Software segment	2
[ UAC ]	User Authentication Credential	2
MSA	Message acknowledgment	2
[[ ERR ]]	Error	2

### 7.3.2 Example

```
MSH|^~\&|ADT_Openxtrem_2015|Openxtrem|SMI - SunTech Medical, Inc.|SMI -
SunTech Medical, Inc.|20150423163442||ACK^R01^ACK|1063|D|2.6|||||UNICODE UTF-
8|||IHE_PCD_001^IHE_PCD^1.3.6.1.4.1.19376.1.6.1.1.1^ISO
MSA|CA|FD02gnFPBFKNWxPT3tp9CE1||||
```

EMR accepted request to store vitals measurement with "CA" (MSA-1)

## 8. Error Codes

For a complete list of error codes reported by the Suntech CT40, Please see Chapter 12 of the SunTech CT40 User Manual, p/n 80-0067-00-MO.

### 8.1 Patient ID Error Codes

Error Code	Description of Error
EC 611	Patient ID was unknown
EC 612	No PID Segment was returned
EC 613	Multiple Patients matched the request
EC 614	Malformed PID Segment
EC 701	Barcode Error – Error while reading from the device
EC 702	Barcode Error – Error reading all bytes from the device
EC 703	Barcode Error – Error while polling the event device
EC 704	Barcode Error – Read barcode was too long
EC 705	Barcode Error – Read barcode was too long (including check digit)
EC 706	Barcode Error – Read barcode was too short

### 8.2 Vitals Measurement Error Codes

Error Code	Description of Error
EC 601	No Network Connection
EC 602	Connection timed out
EC 603	Connection was refused
EC 604	SSL Handshake failed
EC 605	Connection to host failed
EC 606	Error while sending to server
EC 607	Could not transfer all data to server
EC 608	Could not parse received answer
EC 609	Server sent unexpected answer
EC 610	Server has rejected our MSG