IN Cell Analyzer

Remote Control Interface

Introduction

The remote control interface provides external access to the scanning mechanisms within the INCell. Described below are the high-level commands that can be used to select acquisition protocols (XAQP files), load plates, start scans, and obtain status from the instrument.

The remote control interface is designed to work with a TPCIP socket connection. The host and port number are configurable (see below).

The terms "command" and "message" are interchangeable within this document.

Command names are highlighted in italics or quotes to distinguish them from adjacent text.

Be sure to review the section titled "Known Failure Conditions" to avoid common failure types.

Version Information

No significant changes have been made to the remote control protocol since the early development of the protocol. The essence of the protocol has not been changed for several years; recent versions of the INCell software (including versions between 4.0 and 7.1) should all behave in the same way.

New commands added for V6.1 (circa March 2016):

GetSerialNumber
Returns the instrument serial number.

GetVersionNumber
Returns the INCell software version number.

Changes introduced in INCell V6.2 (circa October 2016):

The remote control interface will now disconnect from the client if a scanner hardware error is detected. This change was introduced to help reduce the possibility of the robot incorrectly assuming that the instrument door is open and that INCell is ready for the next plate. Clients should always check the connection before loading or unloading plates.

Uncomment the following line to disable this feature.

```
<!-- <disable>disconnect_on_error</disable> -->
```

In the case where an INCell software upgrade appears to have caused a new failure, refer to the list of known failures conditions at the end of this document.

New commands added for V7.2 (circa March 2018):

GetPlateSensorStatus
Returns the status of the sample and source plate sensors.

GetImagerStatus
Same as the existing command called *GetStatus*. The new name makes more sense, because the return message is called *ImagerStatus*. The original command name is still recognized and supported.

Configure
At present, there is only one option for *Configure*. Use the command to suppress (or enable) unsolicited messages that originate from INCell. Suppressing unsolicited messages will simplify the task of synchronizing with INCell's remote control states. GE recommends setting this "**true**", although the default is "**false**" for backwards compatibility. The default setting can be controlled with the configuration setting shown below.

```
<suppress_unsolicited_robotics_messages>true</suppress_unsolicited_robotics_messages>
```

Refer to the section titled "Synchronization" for a description of which message are suppressed when the flag is set to "**true**".

PlateNotDetected

A new response to ***PlateInserted***. Refer to the reference section for details.

New behavior for V7.3 (circa May 2019):

StartScan

Starting with V7.3, INCell will not accept ***StartScan*** commands unless the instrument is in state 3 (waiting for *StartScan*). Prior to V7.3, INCell would accept the command and start the scan under certain conditions, for example, during the load delay time (state 2). Remote control clients that relied on the original behavior will need to be modified. Scans will not start except when INCell is in state 3. Instead, an error message will be returned to the client. The error will also be recorded in the INCell log file. The remote control client must wait until INCell reaches state 3 before issuing a ***StartScan***.

System Architecture

The basic architecture of the INCell software, hardware, and remote control interface is shown in the following diagram.

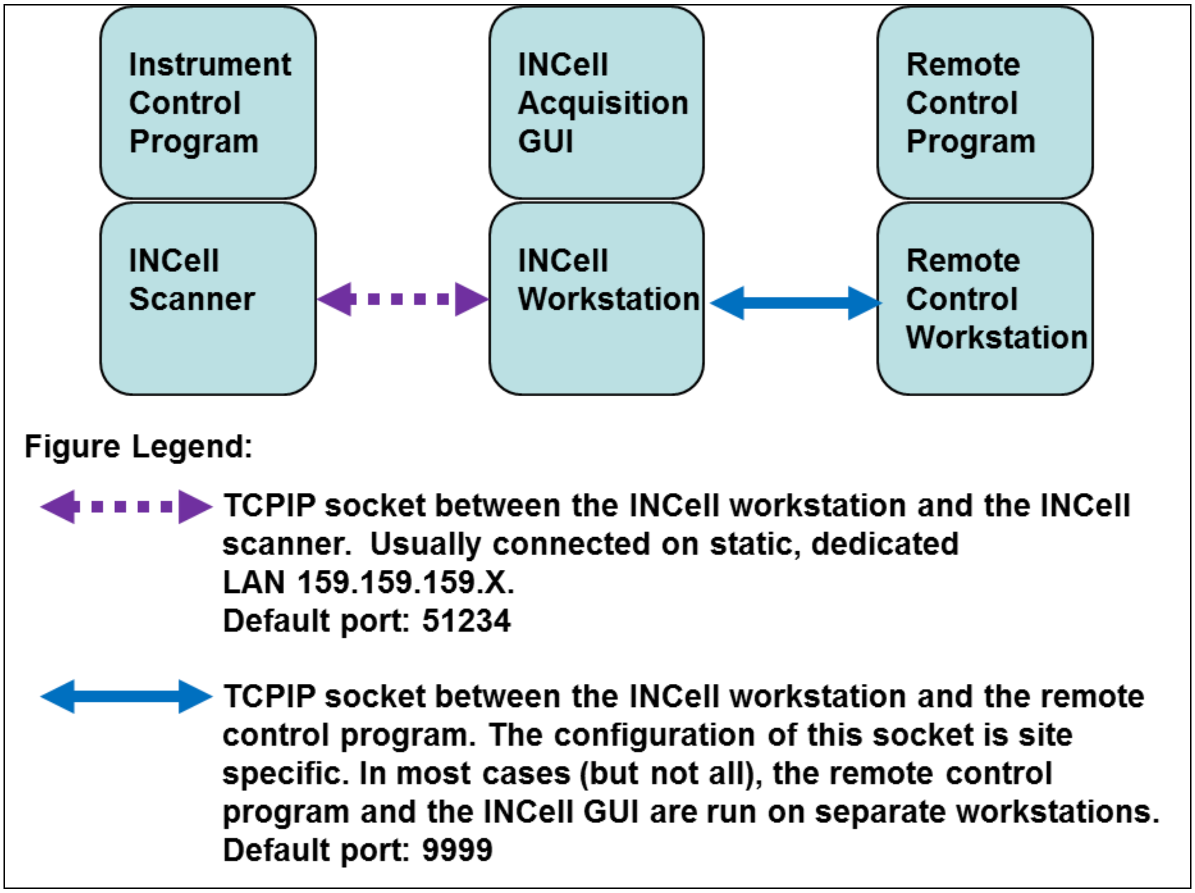


Figure Legend:

TCPIP socket between the INCell workstation and the INCell scanner. Usually connected on static, dedicated LAN 159.159.159.X.
Default port: 51234

TCPIP socket between the INCell workstation and the remote control program. The configuration of this socket is site specific. In most cases (but not all), the remote control program and the INCell GUI are run on separate workstations.
Default port: 9999

INCell Configuration Settings

Certain remote control behaviors can be modified using settings within the INCell program's main configuration file. The files have names like the following:

C:\Program Files\GE Healthcare\IN Cell Analyzer 2200\config\IN Cell Analyzer 2200.xml
C:\Program Files\GE Healthcare\IN Cell Analyzer 2200\config\IN Cell Analyzer 2200.xml_default

When operating the automation client and the INCell software on the same workstation, set the host name to "localhost". The port number must be chosen to avoid conflicts with other ports that may be in use within the site's network.

```
<automation_server_socket host="localhost" port="9999" />
```

To disable all communication that originates from INCell, add the following line to the configuration file:

```
<suppress_unsolicited_robotics_messages>true</suppress_unsolicited_robotics_messages>
```

This setting is only available with software builds larger than 11473. GE recommends suppressing unsolicited communication.

To change the load delay time, modify the "load_delay" setting. Load delay times are in milliseconds.

```
<load_delay>3000</load_delay>
```

To prevent the use of protocol names with special characters, modify the following line:

```
<!-- Naming convention for protocols. -->
<!-- This defines the character set allowed in the names. -->
<naming_convention allowed_charset="A-Za-z0-9_ \-\."/>
```

This setting is only available with software builds larger than 11689.

Remote Control States

When operating in remote control mode, the INCell can be in one of 6 states, as diagrammed below. Pressing the "Disable" button within the GUI will also close the TPCIP socket, disabling communication with the remote control client.

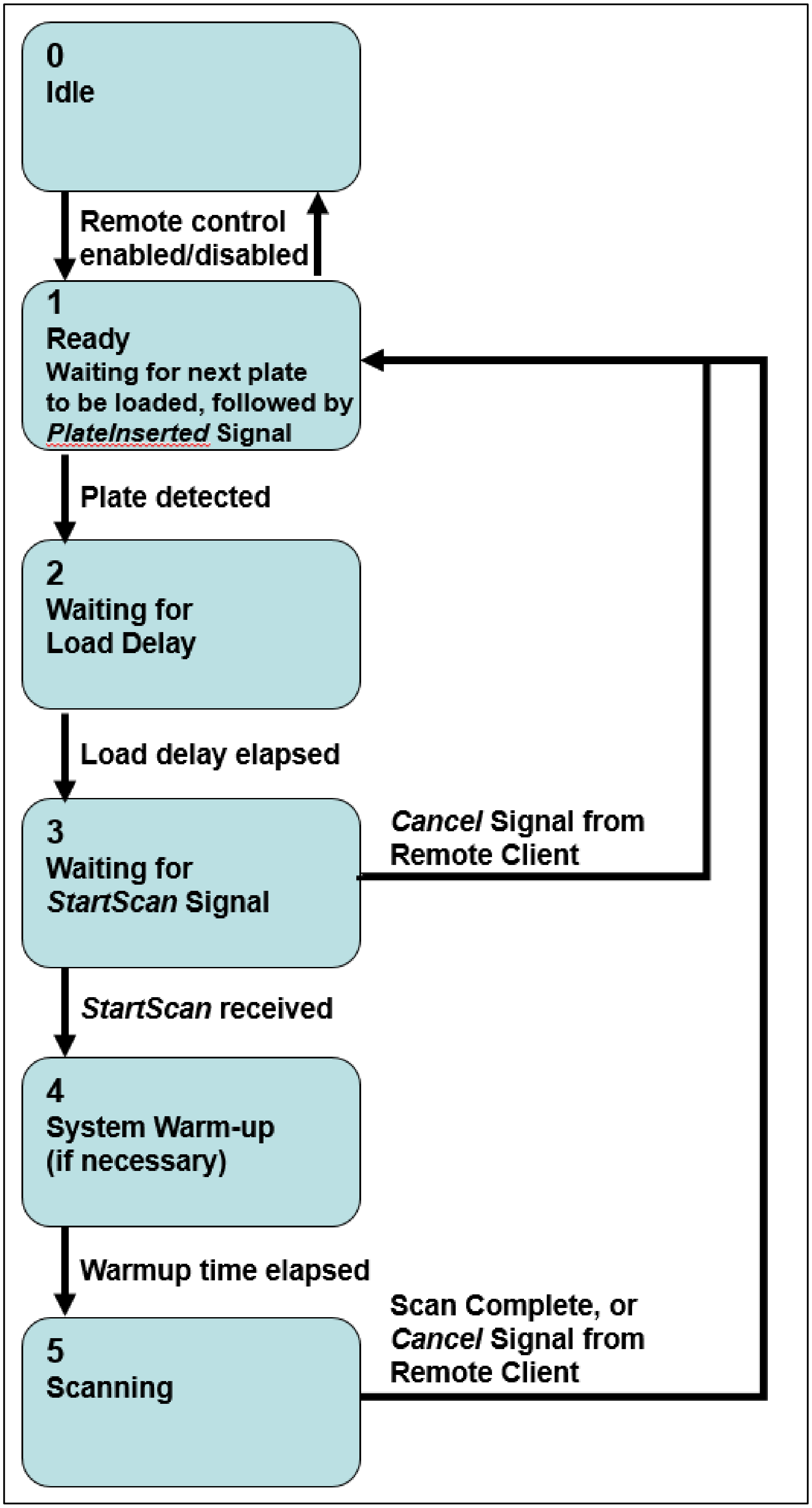

0
Idle
Remote control enabled/disabled
1
Ready
Waiting for next plate to be loaded, followed by *PlateInserted* Signal
Plate detected
2
Waiting for Load Delay
Load delay elapsed
3
Waiting for *StartScan* Signal
Cancel Signal from Remote Client
StartScan received
4
System Warm-up (if necessary)
Warmup time elapsed
5
Scanning
Scan Complete, or *Cancel* Signal from Remote Client

Table of Imager States

State	Description
0	Idle
1	Waiting for Next Plate. Door is open.
2	Load delay. Door closes.
3	Waiting for ***StartScan*** message from Remote client.
4	System Warm Up (applies to the INCell 2000 arc lamp)
5	Scanning. Door is closed.

Synchronization

The original design of the RC protocol supported two different methods of synchronization:

1. client polls INCell with ***GetImagerState***.
2. client listens for status messages (like ***Ready*** and ***ScanComplete***) from INCell.

GE recommends method 1, because the client can request the current state at any time, and because multiple requests are allowed. The status code returned from ***GetImagerState*** is sufficient for synchronizing with the INCell. Waiting for spontaneously generated status messages from INCell is unnecessary.

Synchronization based on method 2 is more difficult and therefore deprecated. INCell will typically send only one status message per state change. The client must then catch every message and must keep track of the order in which the messages are received. If the client misses a message regarding a state change, the client may stall while waiting for a message that will not reoccur.

It is important for the client to handle situations where INCell sends a status message at approximately the same time that the client requests status with ***GetImagerState***. In this situation, the client could potentially receive another message (like ***Ready***) before the expected response (***ImagerState***). The proper method of handling the communication is for the client to continue reading messages until the expected type of message is found. For example, when requesting the state with ***GetImagerState***, continue reading messages until reaching ***ImagerState***.

Although certain versions of the INCell software may send multiple status message per state change, the protocol does not include specifications about replicated messages. Clients should not expect that status messages will be repeated.

Starting with V7.2, the RC protocol can be configured to use only method 1 (polling) for synchronization. The table below summarizes the messages that will not occur when ***SuppressUnsolicited*** is set to **true**. Synchronization with INCell is then simpler, because the remote control client will not need to handle unexpected messages at unexpected times.

Suppressed Message	***Situation***
`<m:ImagerMessage>"Scan new well"</m:ImagerMessage/>`	A new well is being scanned.
`<m:ImagerState><m:Number>N</m:Number> </m:ImagerState>`	The remote control state has changed to N.
`<m:ScanComplete/>`	INCell has finished scanning the current plate.
`<m:Ready/>`	INCell is ready for another plate.

Additional Notes about the Remote Control States:

The software will jump to state 0 (idle) if any sort of instrument failure occurs during operation.

INCell 2200, 2500, 6000, and 6500 systems do not have arc lamps. The warm-up time (state 4) is essentially zero.

Only states 1 and 3 can be reliably detected by polling with the ***GetImagerState*** command. All of the other state changes could be missed, especially when using a long polling interval. Polling mechanisms should handle the case were states 2, 4, or 5 are not detected during operation.

Document Format

Command/Message - Field Name(s)
Origin of the Communication
Contents, if any
Description
Example
Response Command/Message, if any

Commands/Messages that Originate From the Remote Client

Abort **- Reason**

Remote client command

Reason for abort

A signal from the remote client that the current scan should be aborted as soon as possible. INCell will exit from remote control mode. The plate will not be ejected.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:Abort>
            <m:Reason>Reason</m:Reason>
      </m:Abort>
</soap:Body>
</soap:Envelope>
```

Cancel **- Reason**

Remote client command

Reason for cancellation.

Cancel the current scan, eject the plate, remain in remote control mode for further scanning.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:Cancel>
            <m:Reason>Text string with an explanation</m:Reason>
      </m:Cancel>
</soap:Body>
</soap:Envelope>
```

ClientMessage **- Message**

Remote client command

A message to be recorded in the INCell software's log file. Useful for diagnostic purposes. (Previous documents claimed that the message would be presented to the user in a dialog box, but that is not the case.)

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:ClientMessage>
        <m:Message>Message from the remote client</m:Message>
      </m:ClientMessage>
</soap:Body>
</soap:Envelope>
```

Configure

Remote client command

A message for configuring the remote control session. To simplify the communication protocol and synchronization set ***SuppressUnsolicited*** to **true**. INCell will respond with ***ConfiguredState***. New, as of V7.2. For more information, refer to the discussion at the beginning of this document.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
    <m:Configure>
      <m:SuppressUnsolicited>[true|false]</m:SuppressUnsolicited>
```

```
            </m:Configure>
        </soap:Body>
        </soap:Envelope>
```

ImageStack **- BaseFolder - FolderNaming**

Remote client command

Base folder path and folder naming method for the image stack.

This, combined with the protocol name, determines the resulting image stack folder. The annotation tag can be used for the plate's barcode. Note that the annotation tag has always been available in the remote control protocol, even though the tag was not documented until INCell V6.1.

Starting with INCell V7.2, the "SCRATCH" method of folder naming has been deprecated. The purpose of scratch folders is for testing acquisition parameters, rather than recording permanent scan data. By design, INCell will delete all scratch data when starting a scan. Avoiding file access problems with external programs is almost impossible.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:ImageStack>
            <m:BaseFolder> c:\GE\INCell </m:BaseFolder>
            <m:FolderNaming> [DATETIME|UNIQUE] </m:FolderNaming>
            <m:Annotation> text string (e.g. barcode) </m:Annotation>
      </m:ImageStack>
</soap:Body>
</soap:Envelope>
```

GetImagerState

Remote client command

A request of the imager; the imager will respond with the ***ImagerState***.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:GetImagerState/>
</soap:Body>
</soap:Envelope>
```

GetImagerStatus

Remote client command

A request for the imager status; the imager will respond with ***ImagerStatus***. In most cases it is easier to obtain status using individual commands (like ***GetImagerState***), rather than ***GetImagerStatus***. The full status message provided with ***ImagerStatus*** can be difficult to handle. Note that ***GetStatus*** is the same command as ***GetImagerStatus***.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:GetImagerStatus/>
</soap:Body>
</soap:Envelope>
```

GetLampStatus

Remote client command

A request of the imager; the imager will respond with the **Lamp** status. Intended for the IC2000, rather than the IC2200 or IC6000.

```
<?xml version="1.0"?>
```

```
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:GetLampStatus/>
</soap:Body>
</soap:Envelope>
```

GetLastImageStack

Remote client command

A request of the imager; the imager will respond with ***LastImageStack***.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:GetLastImageStack/>
</soap:Body>
</soap:Envelope>
```

GetPlateHeaterStatus

Remote client command

A request of the imager; the imager will respond with ***PlateHeater***.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:GetPlateHeaterStatus/>
</soap:Body>
</soap:Envelope>
```

GetPlateSensorStatus

Remote client command

A request of the imager; the imager will respond with ***PlateSensors.***

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelop"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
   <m:GetPlateSensorStatus/>
</soap:Body>
</soap:Envelope>
```

GetPlateStatus

Remote client command

A request of the imager; the imager will respond with the ***Plate*** status. Note that the response is "Plate" rather than "PlateStatus".

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:GetPlateStatus/>
</soap:Body>
</soap:Envelope>
```

GetSerialNumber

Remote client command

Request the instrument serial number. The imager will respond with ***SerialNumber***. New, as of V6.1.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:GetSerialNumber/>
</soap:Body>
</soap:Envelope>
```

GetStatus

Remote client command

GetStatus is the same as ***GetImagerStatus***. The preferred name is "GetImagerStatus", because both commands return ***ImagerStatus***.

GetVersionNumber

Remote client command

Request the INCell software version number. The imager will respond with ***VersionNumber***. New, as of V6.1.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:GetVersionNumber/>
</soap:Body>
</soap:Envelope>
```

Password

Remote client command

Protocol password

The password for the protocol (optional, if needed)

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:Password>Password</m:Password>
</soap:Body>
</soap:Envelope>
```

PlateInserted

Remote client command

Inform the INCell that a new plate has been loaded. INCell will confirm the presence of the plate using a sensor and then respond with the ***Loaded*** message, if appropriate. In the event that a plate is not detected, INCell will return to state 1 and wait for some sort of recovery to occur. Starting with V7.2, INCell may respond with ***PlateNotDetected***. but only when configured with ***SuppressUnsolicited*** set to **true**. The original, default behavior is unchanged.

INCell must be in state 1 in order to handle the *PlateInserted* message. The message will be ignored if INCell is in any other state.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:PlateInserted/>
</soap:Body>
</soap:Envelope>
```

***Protocol* - XAQP**

Remote client command

Acquisition Protocol Name

The name of the acquisition protocol [file name] to run. The requested protocol file must exist in the expected folder on the INCell workstation. The protocol name must exist in the list returned by ***ProtocolList***.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:Protocol>
            <m:XAQP>protocol1.xaqp</m:XAQP>
      </m:Protocol>
</soap:Body>
</soap:Envelope>
```

StartScan

Remote client command

A signal from the Remote client that the scan should be started. Only send ***StartScan*** when INCell is in state 3. Under normal circumstances, ***StartScan*** will respond with ***ImagerMessage*** that contains "Start scan". Other possible imager messages are "Protocol has not been loaded" and "Image stack has not been assigned**".**

Note that INCell may remain in state 3 (waiting for StartScan) for a brief period (~0.1 secs) before transitioning to state 4/5.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:StartScan/>
</soap:Body>
</soap:Envelope>
```

Communication that Originates from the INCell

ConfiguredState - RC Configuration information

INCell Imager

RC protocol configuration settings.

Configuration settings for the RC protocol.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
    <m:ConfiguredState>
      <m:SuppressUnsolicited>true|false</m:SuppressUnsolicited>
    </m:ConfiguredState>
</soap:Body>
</soap:Envelope>
```

ImagerMessage - Message

INCell Imager

Message from INCell imager

A general purpose message. GE recommends logging the contents of this message. Handling unsolicited ***ImagerMessage*** messages is an important part of synchronizing with INCell.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:ImagerMessage>
            <m:Message>Text message from INCell</m:Message>
      </m:ImagerMessage>
</soap:Body>
</soap:Envelope>
```

ImagerState - Number

INCell Imager

State ID number

Returns one of the state numbers shown in the remote control state table (see table of "Imager States"). For example,

Original format:

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:ImagerState>
            <m:Number>5</m:Number>
      </m:ImagerState>
</soap:Body>
</soap:Envelope>
```

```
With optional MessageID (new for V6.2):
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:ImagerState>
            <m:Number>5</m:Number>
            <m:MessageID>unique_id_string</m:MessageID>
      </m:ImagerState>
</soap:Body>
</soap:Envelope>
```

***ImagerStatus* - Plate - Status**

INCell Imager

Message contents:

1. Plate status.
2. Lamp status
3. Plate Heater status.
4. ImagerState.
5. LastImageStack
6. ProtocolList
7. Protocol

Response message to the Remote client command ***GetStatus***. The response contains a full description of the INCell status, rather than a simple code number. To query just the state, use ***GetImagerState*** instead.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:ImagerStatus>
            <m:Plate>
                  <m:Status>UNLOADED</m:Status>
            </m:Plate>
            <m:Lamp>
                  <m:Status>OFF|WARMING|READY</m:Status>
                  <m:SecondsUntilReady>120</m:SecondsUntilReady>
            </m:Lamp>
            <m:PlateHeater>
                  <m:Status>ON|OFF</m:Status>
                  <m:TargetTemperature>25.0</m:TargetTemperature>
                  <m:CurrentTemperature>90.0</m:CurrentTemperature>
            </m:PlateHeater>
            <m:ImagerState>
                  <m:Number>5</m:Number>
            </m:ImagerState>
            <m:LastImageStack> c:\GE\INCell </m:LastImageStack>
            <m:ProtocolList>
                  <m:Protocol>protocol1.xdce</m:Protocol>
                  <m:Protocol>protocol2.xdce</m:Protocol>
                  <m:Protocol>protocol3.xdce</m:Protocol>
                  <m:Protocol>protocol4.xdce</m:Protocol>
            </m:ProtocolList>
            <m:Protocol>
                  <m:Status>true|false</m:Status>
             </m:Protocol>
      </m:ImagerStatus>
</soap:Body>
</soap:Envelope>
```

***Lamp* - Status - SecondsUntilReady**

INCell Imager

Returns status of the lamp {"WARMING", "READY", or "OFF"}. Only relevant for the 2000. Other instruments are always ready.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:Lamp>
            <m:Status>WARMING|READY|OFF</m:Status>
            <m:SecondsUntilReady>120</m:SecondsUntilReady>
```

```
        </m:Lamp>
</soap:Body>
</soap:Envelope>
```

LastImageStack

INCell Imager

Name of the current/last image stack folder. Useful in cases where the INCell (rather than the Remote client) generates the image stack folder name. The messages is also useful for clients that do not have a simple connection between the module that initiates the scan and the module that gathers the data.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:LastImageStack> c:\GE\INCell </m:LastImageStack>
</soap:Body>
</soap:Envelope>
```

Loaded

INCell Imager

A signal that a plate is currently loaded in the plate carrier. When loaded, the INCell door will be closed. Remote control clients should not attempt to retrieve plates when the INCell is loaded.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:Loaded/>
</soap:Body>
</soap:Envelope>
```

***Plate* - Status**

INCell Imager

Returns status of the plate as a text string.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:Plate>
            <m:Status>LOADED|UNLOADED</m:Status>
      </m:Plate>
</soap:Body>
</soap:Envelope>
```

PlateHeater **- Status - TargetTemperature - CurrentTemperature**

INCell Imager

Returns status, target temperature and current temperature of the plate heater.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:PlateHeater>
            <m:Status>ON|OFF</m:Status>
            <m:TargetTemperature>30.0</m:TargetTemperature>
            <m:CurrentTemperature>29.0</m:CurrentTemperature>
      </m:PlateHeater>
```

```
    </soap:Body>
    </soap:Envelope>
```

PlateNotDetected

INCell Imager

An error message that may be returned from ***PlateInserted***. INCell uses the sample plate sensor within the plate carrier to determine whether the plate was successfully loaded. The message is new for V7.2. Previous versions of software did not contain this response. INCell will only send ***PlateNotDetected*** when unsolicited is set to **true**. See ***PlateInserted*** for more information.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelop"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
    <soap:Body>
        <m:PlateNotDetected/>
   </soap:Body>
</soap:Envelope>
```

PlateSensors

INCell Imager

Returns the status of the sample plate sensor and the source plate sensor. "1" indicates that a plate is present, "0" indicates that a plate is not detected.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelop"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
    <soap:Body>
        <m:PlateSensors>
           <m:Sample>0|1</m:Sample>
           <m:Source>0|1</m:Source>
        </m:PlateSensors>
   </soap:Body>
</soap:Envelope>
```

***ProtocolList* - Protocol**

INCell Imager

A list of acquisition protocols available to the Remote client. The list is generated from the contents of INCell's AQP folder. Clients should be prepared to handle long lists. To reduce the size of the list, remove files from INCell's AQP folder.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:ProtocolList>
            <m:Protocol>protocol1.xdce</m:Protocol>
            <m:Protocol>protocol2.xdce</m:Protocol>
            <m:Protocol>protocol3.xdce</m:Protocol>
            <m:Protocol>protocol4.xdce</m:Protocol>
      </m:ProtocolList>
</soap:Body>
</soap:Envelope>
```

Ready

INCell Imager

A signal that the current plate has been scanned and that the INCell is ready for the next plate. The ready state also indicates that the door is open. Rather than relying on the ***Ready*** message, however, clients should explicitly request the imager state using ***GetImagerState***. Looking for the condition ***ImagerState***==1 is better than attempting to catch the ***Ready*** signal.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
```

```
<soap:Body>
      <m:Ready/>
</soap:Body>
</soap:Envelope>
```

ScanComplete

INCell Imager

A signal that a plate scan has completed. The signal is for information purposes only. Do not use ***ScanComplete*** for synchronization.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:ScanComplete/>
</soap:Body>
</soap:Envelope>
```

SerialNumber

INCell Imager

The instrument serial number. New, as of V6.1.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:SerialNumber>MK29999</m:SerialNumber>
</soap:Body>
</soap:Envelope>
```

VersionNumber

INCell Imager

The INCell software version number. New, as of V6.1.

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2001/12/soap-envelope"
soap:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<soap:Body>
      <m:VersionNumber>
        <m:Id>6.1</m:Id>
        <m:Build>99999</m:Build>
      </m:VersionNumber>
</soap:Body>
</soap:Envelope>
```

Known Failure Conditions and Known Issues

- Premature Client Communication Time-Outs/Disconnections
The remote control client should always wait for a sufficient amount of time before abandoning communication with INCell. The INCell workstation handles large amounts of image data and may not always be able to immediately respond to remote control messages from the client. This is especially true when the INCell has recently finished a large scan.

In the event that a remote client abandons communication with the INCell, the INCell will detect that the client has disconnected from the TCPIP socket. Symptoms of such failures include:

1. The INCell software will report that the client has disconnected. This does not mean that INCell has terminated the connection, but rather that the remote client is no longer present.

2. The instrument will stop at the next state that requires input from the remote client. If the instrument is waiting for the next plate and the ***PlateInserted*** message from the robot, then the IN Cell door will stay open. If the instrument is waiting for the ***StartScan*** message from the client, then the door will remain closed.

- Slow INCell Response Causing Communication Timeout
Certain types of network configurations work very slowly with INCell. For example, commands like ***ImageStack*** can take 10-20 seconds (or longer) to complete. When operating in such conditions, the INCell can become sluggish, which in turn may cause communications with the remote client to timeout. If it is not possible to increase the timeout setting on the remote client, then the following information may be useful when working towards another solution:

Slow combinations
A. Java (INCell) + Windows7 (workstation) + Samba (NAS)
http://stackoverflow.com/questions/14963927/extremely-slow-file-listing-using-java-samba-win-7

B. Java (INCell) + Windows7 (workstation) + Windows Storage Server 2003 (NAS)
http://www.sysprobs.com/windows-7-network-slow

Slow procedures
ImageStack + "UNIQUE" ("DATETIME" is probably OK.)

- Socket Buffer Overflow
Messages that originate from INCell need to be handled by the remote client. In the event that the remote client fails to read messages and thereby clear the socket, the communication port will eventually become clogged with data. The symptom of such a condition is that INCell will hang at the point where it is trying to write data into the socket. The blocking behavior of the socket is inherent to the way TCPIP sockets work. TPCPIP sockets typically have a buffer size of 32768 bytes. There is really no workaround for this condition. It is not possible to simply flush the socket, because the data are no longer owned by INCell. Increasing the buffer size would only delay the issue. The same type of failure could probably happen on the remote client.

Disabling communication that originates from INCell is a possible workaround. For information about INCell's configuration settings, refer to the beginning part of this document.

- Socket Port Interference
If another program attempts to open the port used for communication between INCell and the remote client, the protocol will be disrupted. It is likely that some form of reset will be required. If necessary, use a different port number.

- There is presently no way for the remote control client to inform INCell that the socket is about to be disconnected. To avoid warning messages from INCell, the client should only disconnect when the imager is "idle" (state 0) or "waiting for the next plate" (state 1).

- Protocol file names with special characters like "&" will break the XML/Soap communication between INCell and the client. Prior to INCell 11850, special characters were not properly encoded by INCell. In the case of "&", the character should be encoded as "&amp". At least one type of remote client is known to have the same problem when sending messages to INCell. To avoid this issue, do not use special characters in protocol file names. Note that ***ImagerStatus*** and ***ProtocolList*** communicate the entire list of protocols in the user's folder, which means that this problem can arise even if the offending protocol isn't being used. To fix the problem, it may be necessary to manually rename files in the acquisition protocol folder.

- The Presence of Lots of Protocol Files May Cause a Client Buffer Overrun

If there are lots of protocol files in the folder that contains INCell protocols, then the list of protocols can get very large. In this case, ***ImagerStatus*** and ***ProtocolList*** may contain a very long list of protocol names. The size of the message can be very large, and if the client's receive buffer is not large enough, there may be a buffer overrun (on the remote client).

- Remote Client should only request valid acquisition protocols
By design, INCell will only look for acquisition protocols in a designated location within the INCell workstation's file system. The remote control client should use ***ProtocolList*** to determine what protocols are available. Remote clients should avoid using a file browser to select acquisition protocols, because there is only one allowed source of acquisition protocols. Also, there is no guarantee that the client and INCell can even access the same file system. INCell's remote control mode is designed to work through a network socket. To view or modify the location used to store acquisition protocols, use the Preferences dialog within the INCell GUI's main menu.

- Rapid Polling with "GetStatus" Consumes Available Memory
Prior to version 5.2 of the INCell software, the logging mechanism that monitored communication between INCell and the client used a small amount of memory during every transaction. In most cases, this did not create a problem, because the memory consumption was small compared to the amount of available memory. In the case where the client rapidly polled INCell with ***GetStatus*** messages, however, it was possible for the log size to become significant. Some contributing factors to consider:

> overly rapid polling by the client (e.g. with a sub-second interval)
> large protocol lists reported within ***ImagerStatus***
> workstations with only 4Gb of RAM

Version 5.2 uses an efficient logging mechanism that is not be susceptible to running out of memory.

- Multiple ***ImagerState*** Messages Can Cause Confusion
ImagerState messages can originate from three different situations (listed below), making it difficult to synchronize communication.

1. RC state changes. In this case, INCell sends the message without being asked.
2. in response to ***GetImagerState***
3. embedded within the response to ***GetStatus***

Starting with V6.2, an optional ID tag can be added to the ***ImagerState*** message. Message ID tags can be helpful when diagnosing communication problems between INCell and the remote control client.

Use the following configuration setting to enable message IDs:

```
   <auto_gen_rc_message_ids>true</auto_gen_rc_message_ids>
```

A unique tag called ***m:MessageID*** will be added to the ***ImagerState*** message.

- Remote Client should not request ***StartScan*** unless the instrument is in state 3
INCell should only be asked to start a scan when the instrument is already in state 3, “Waiting for ***StartScan***”. The INCell software does not handle other cases. The software will not queue the request nor will it automatically wait before starting a scan.

Starting with V7.3, the INCell software will reject ***StartScan*** commands unless in state 3. Remote control clients should always check for this condition before sending ***StartScan***. Prior to V7.3, however, INCell would accept the request in certain situations. A variety of other failures (HW and SW) could have occurred. In one case, the software simply stalled and would not continue. The unknown condition of the hardware and software was not part of the remote control protocol. ***StartScan*** cannot be accepted unless the instrument is in state 3.

Sample Client Programs (Python)

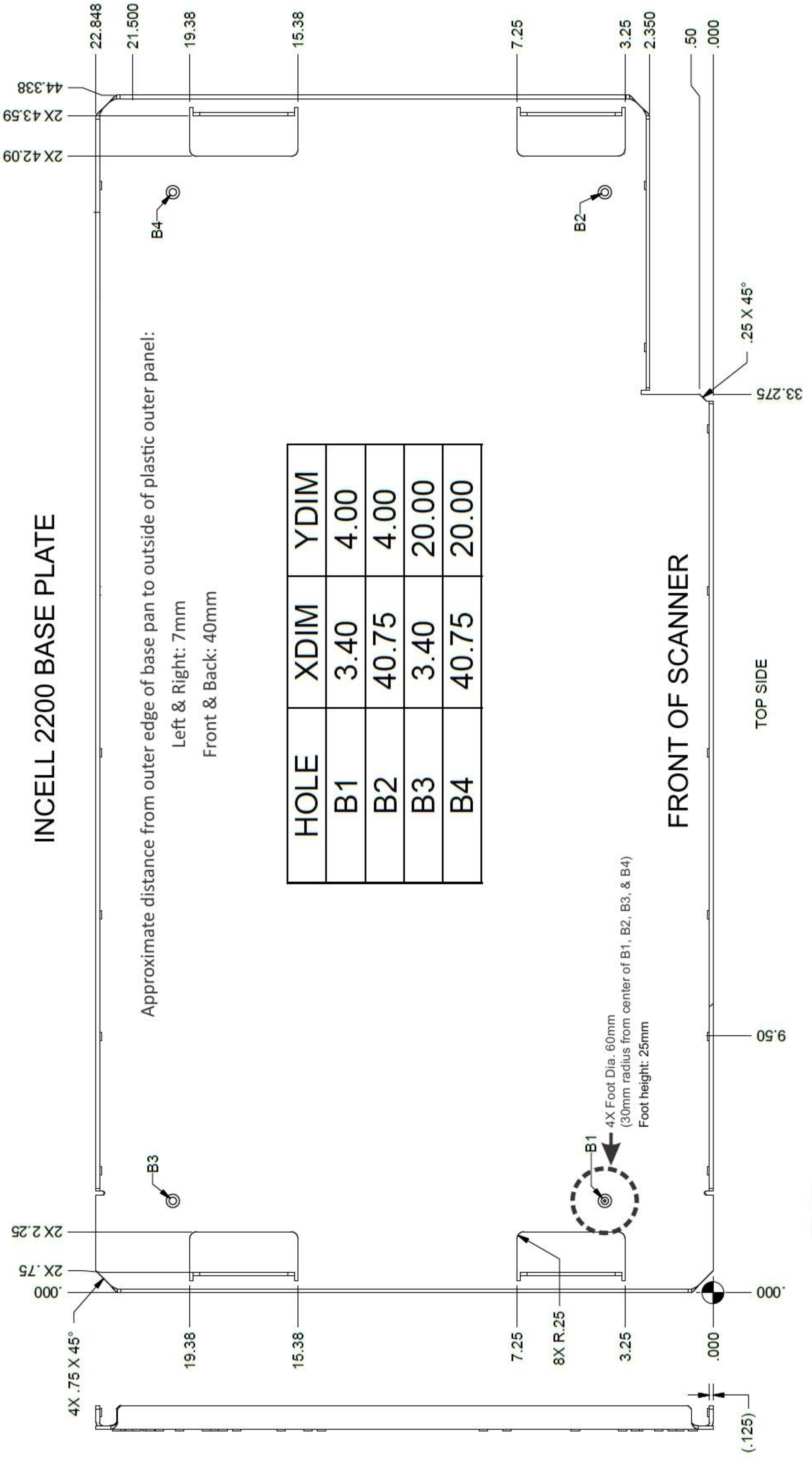
Two sample programs are included within the "ThirdParty" folder of the INCell installation.

```
remote_control_sample_client_polling.py
remote_control_sample_client_listening.py
```

As indicated by the filenames, one of the programs uses polling (method 2) for synchronization and the other listens (method 1) for messages from INCell. Both programs contain comments and examples that may be helpful when developing new control programs.

IN Cell Analyzer 2200/2500 - Base Plate

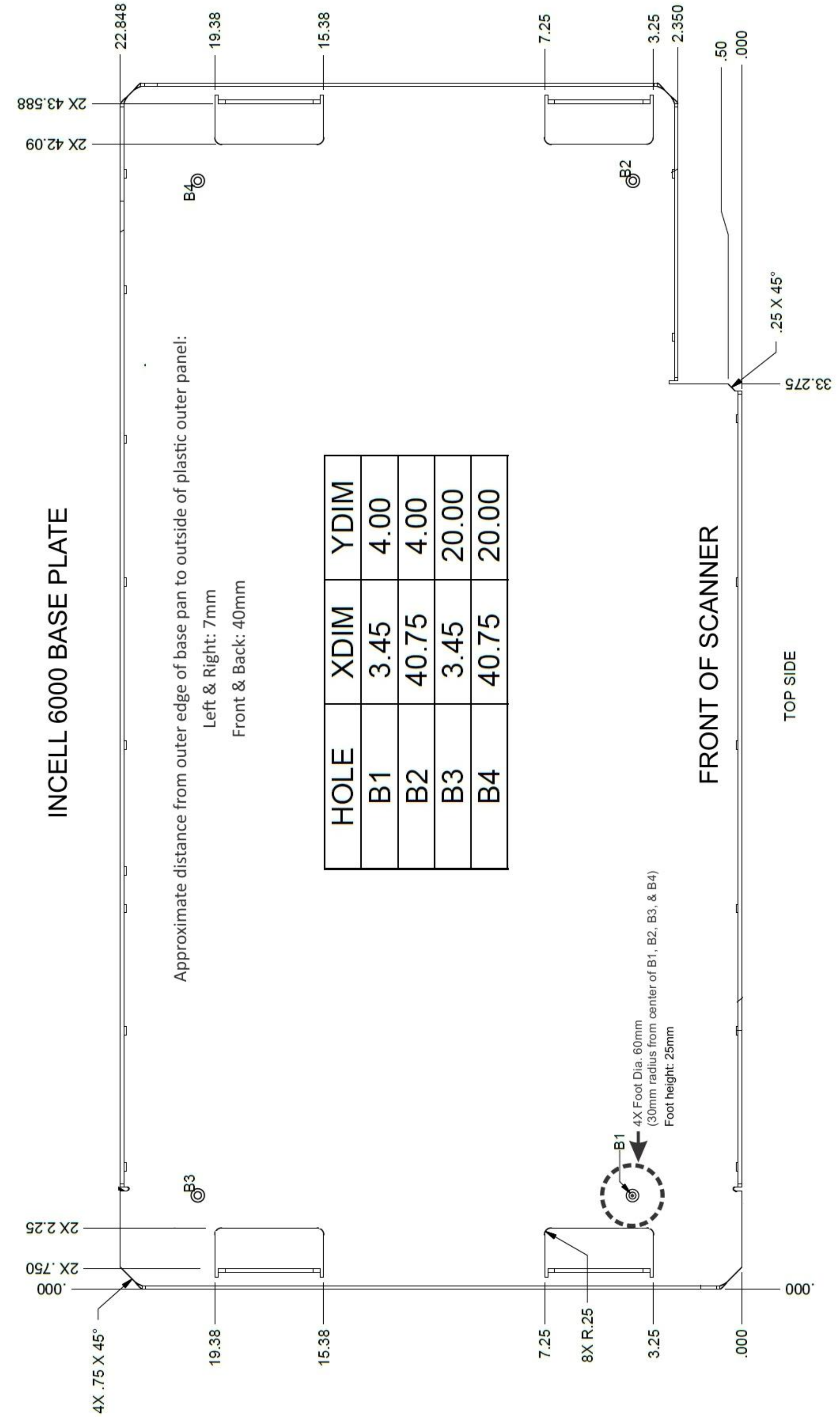
The 2200/2500 dimensions are very similar to the 2000's dimensions. Only the foot locations on the base plate are different. The plate carriers are identical.



HOLE	XDIM	YDIM
B1	3.40	4.00
B2	40.75	4.00
B3	3.40	20.00
B4	40.75	20.00

IN Cell Analyzer 6000/6500 - Base Plate

The 6000/6500 dimensions are very similar to the 2000's dimensions. Only the foot locations on the base plate are different. The plate carriers are identical.



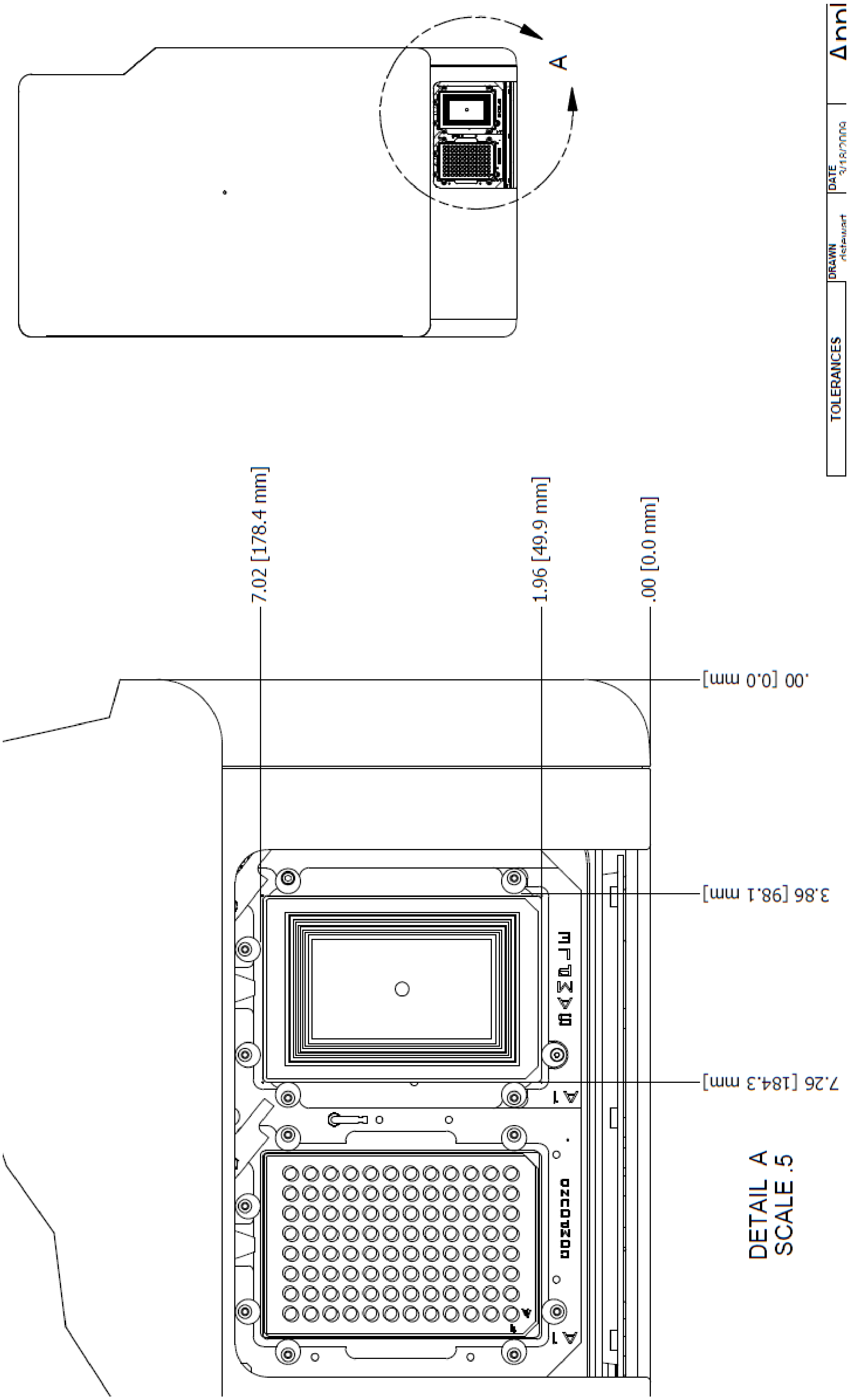
INCELL 6000 BASE PLATE

Approximate distance from outer edge of base pan to outside of plastic outer panel:
Left & Right: 7mm
Front & Back: 40mm

HOLE	XDIM	YDIM
B1	3.45	4.00
B2	40.75	4.00
B3	3.45	20.00
B4	40.75	20.00

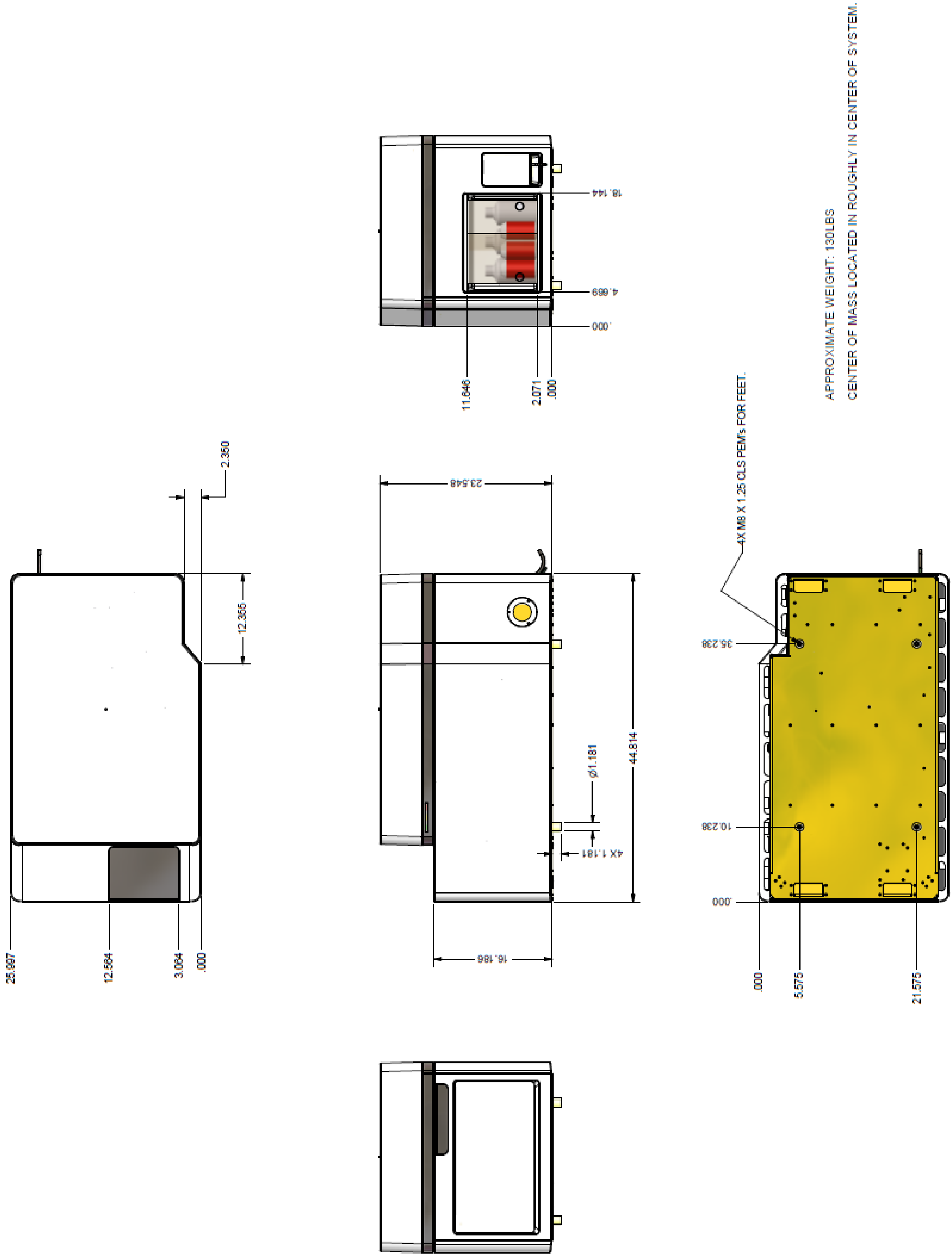
4X Foot Dia. 60mm
(30mm radius from center of B1, B2, B3, & B4)
Foot height: 25mm

IN Cell Analyzer 2000 - Plate Carrier Top View

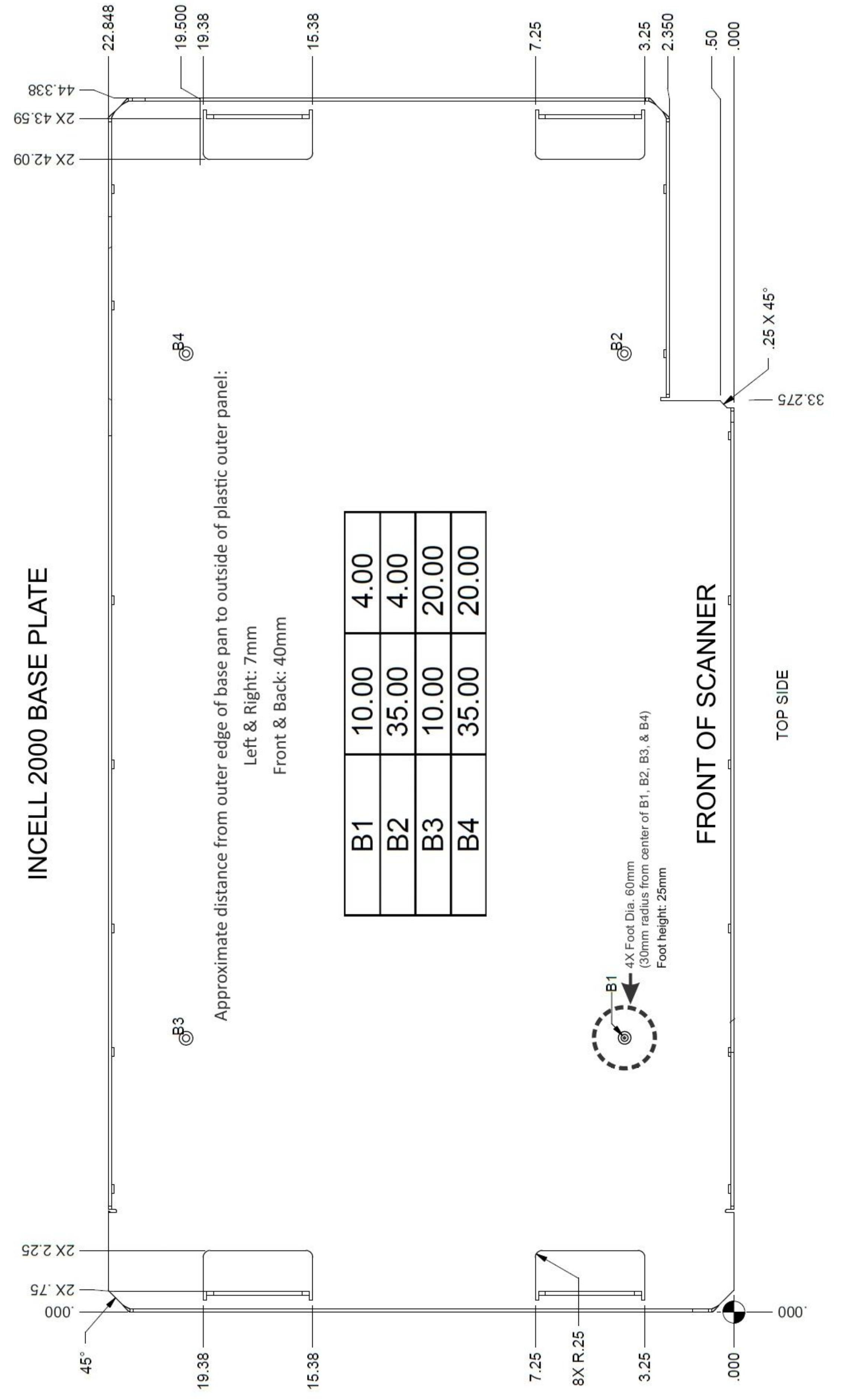


IN Cell Analyzer 2000 - Overall Dimensions

IN Cell Analyzer 2000 - Outer Envelope



IN Cell Analyzer 2000 - Base Plate



Approximate distance from outer edge of base pan to outside of plastic outer panel:

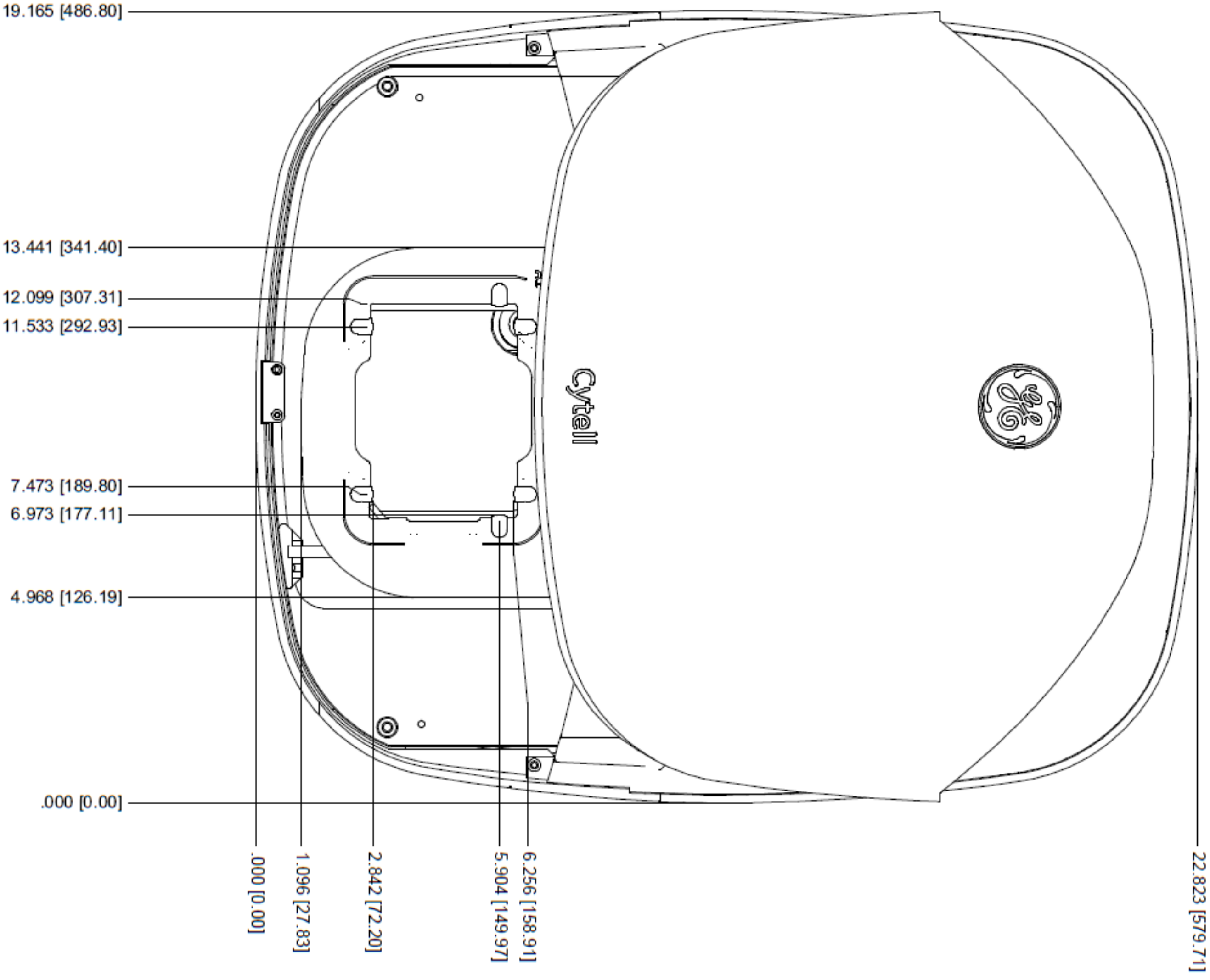
Left & Right: 7mm

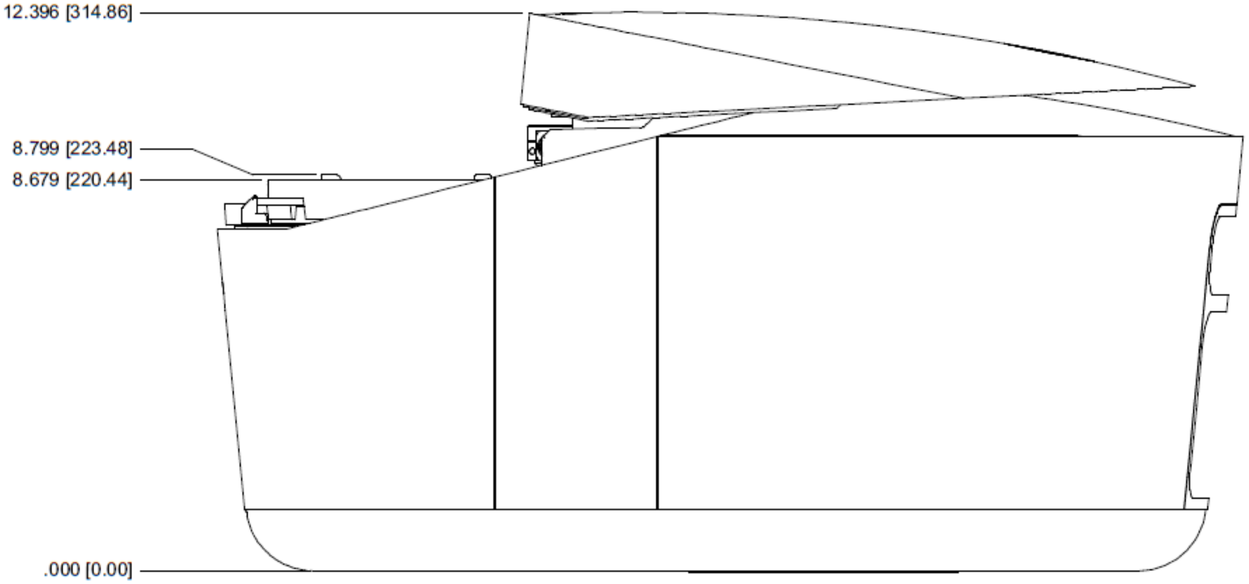
Front & Back: 40mm

B1	10.00	4.00
B2	35.00	4.00
B3	10.00	20.00
B4	35.00	20.00

4X Foot Dia. 60mm
(30mm radius from center of B1, B2, B3, & B4)
Foot height: 25mm

Cytell


19.165 [486.80]
13.441 [341.40]
12.099 [307.31]
11.533 [292.93]
7.473 [189.80]
6.973 [177.11]
4.968 [126.19]
.000 [0.00]
Cytell
.000 [0.00]
1.096 [27.83]
2.842 [72.20]
5.904 [149.97]
6.256 [158.91]
22.823 [579.71]


12.396 [314.86]
8.799 [223.48]
8.679 [220.44]
.000 [0.00]