A Medtronic

Project Name: Janus

Authored By: Brent Johnson

	Version History	
Version	Description of Change	Change Author
2.0	Initial Release	Brent Johnson

Cabinets/Neuromodulation/NPD-Neuro Project Documents/NDHF-Design History Files/NDHF1506 TEL A-N Fob/03. Design Outputs/3.04. Electrical

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1 APPENDIX A – STEPS TO PROGRAM .DFI FILE

1. Connect the Janus battery to the Texas Instruments EV2300 USB to I2C converter as shown in Figure 1.



Figure 1: Janus Battery Connected to EV2300

- 2. Open bq Evaluation Software
- 3. Click on the bqEASY icon on left side of bq Evaluation Software as shown in Figure 2.



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Title: Janus Fob Battery Work Instruction

d Texas Instru	ments bq Gas Gauge Evaluati	ion Softwa	are - bo	27541\	/200 v.	2.00 - [SBS Data]					
🗳 File Optio	ons AutoCycle View Wi	indow H	lelp								_ 8
	TEXAS INSTRUME Refresh Start Logging Logg	ents op Canada Sc	<u>K</u> eep anning		REA	ALWORLDS	IGN	A L	Р	R O C E S S I N G	M
	Name	Value	Unit	Log Sc	an	Name	Value	Unit	Log	Scan	
<u> </u>	Control	0019	hex	<u>ا ک</u>	7	Standby Current	-1	mA	V		
	Control Status	0019	hex		7	Standby Time to Empty	24300	min			
	At Rate	0	mA	V 1	7	Maximum Load Current	-45	mA			
Data	At Rate Time To Empty	65535	min	V 1	7	Max Load Time to Empty	540	min	•		
Flat	Temperature	20.0	deqC		7	Available Energy	1534	mWh			
Flash	Voltage	4131	mV		7	Average Power	0	mW	V		
	Flags	0180	hex		-	Time to Empty Const Power	65535	min			
	NomAvailCap	405	mAh	V	7	Internal Temperature	20.7	degC			
TOC Pro	Full Available Capacity	433	mAh	V 1	7	Cycle Count	0	-			
120 Pro	Remaining Capacity	405	mAh		-	State of Charge	94	%			
	Full charge Capacity	433	mAh		-	State of Health	100	-			
	Average Current	0	mA		-	Passed Charge	0	mAh	•		
Calibrata	Average Time to Empty	65535	min		-	DODO	1136	-	•		
Cambrare	Average Time to Full	65535	min		2	Pack Configuration	0131	-			
bqEASY	Flags / Status Bits Control Status - SCANN SE FAS SHUTDWN HIBERNATE	IING SS FULLSLEE	EP S	CSV		CA BCA TSM MD RUP_DIS VOK	GB QEN				
•	Flags - SCANNING										
	OTC OTD	RSVD	_	MTL	CHG_	INH XCHG FC	CHG				
100%	Dask Castieventian C			5_511	<u> 304</u>		030				
	RESCAP DSVD	RSVD		SVD	GNP	SEL TWAKE DENSI	RSNS	0			
	RSVD RFACTSTEP	SLEEP	R	MFCC	SE.	PU SE_POL SE_EN	TEMP	5			
0%			Show F	005						Show Static Data	
Fuel Gauge 94%	Scan Off Device 5	41 Ver:2 0	0	-9*	-					onon orano <u>o</u> ara	
Communication D	K.		-		-				SBS T	ask Progress: 100% Task Co	ompleted. 02:36:38 '

Figure 2: bqEaSY Icon in bq Evaluation Software



4. Click on Setup icon as shown in Figure 3.



Figure 3: Setup Icon in bq Evaluation Software



5. Click on Load .DFI File as shown in Figure 4.



Figure 4: Load .DFI File in bq Evaluation Software



6. Select DFI manually as shown in Figure 5.



Figure 5: Selct DFI file manually in bq Evaluation Software

7. Browse to the M960158A003.dfi file that was saved in the M960158A003.zip.



8. Click the Program Dataflash Image button as shown in Figure 6.

d Texas Instrume	ents bq Gas Gauge Evaluation Software - bq2	7541V200 v2.00 - [bqEasy]	
🗧 File Windo	w Help		_ <i>8</i> ×
	TEXAS INSTRUMENTS	REAL WORLD SIGNAL PROCESSING [™]	
	🕹 Texas Instruments	bqEASY-HH (v1.61) Chemistry Ver. 279	
	bqEASY	1. Setup 2. Configure 3. Calibrate 4. Chemistry 5.	Cycle
DataRAM	Impedance Track Contiguration Wizard	1B. Load .DFI File	
Data	0541 0200		
Flash	1A. Project Name	Its important to initialize the Impedance Track gas gauge with the correct default dataflash	
I2C Pro	1B. Load .DFI File	Image file (.DFI). If you know that this is already the case, then skip this step by clicking "Keep Existing Dataflash Image" Dataflash Image File Options	
Calibrate		○ Use: bq27541_2_00.dfi (recommended)	
		Select DFI file manually Browse	
100%		Selected Default DEL file: J:\Groups\Instruments\Janus Fob\EE\H960158A003\M960158A003.dfi Program Dataflash Image	
0% Fuel Gauge -	G Back Next	Keep Existing Dataflash Image	
Communication OK.		Task Progress: 0%	01:11:48 PM

Figure 6: Program Dataflash Image in bq Evaluation Software



9. Once the gauge is programmed, click the DataRAM icon on the left side of the bq Evaluation Software as shown in Figure 7.



Figure 7: DataRAM Icon in bq Evaluation Software



10. Enable the Impedance Track Algorithm. Click in the Control field, as shown Figure 8. It will let you type in to it. Type 0021. Press the Enter key on keyboard.

q Texas Instrume	nts bq Gas Gauge Evaluati	ion Softwa	re - b	q2754	1V200	v2.00 - [SBS Data]			-			- 0 X
🗳 File Option:	s AutoCycle View Wi	indow H	elp										_ 8 ×
	TEXAS INSTRUME Refresh Start Logging Logg	INTS	<u>K</u> eep anning		RЕ	AL	WORLD S	IGN	AL	Р	ROCESS	IN G [™]	
	Name	Value	Unit	Log	5can	Nam	ie	Value	Unit	Log	Scan		
	Control	0021	hex	☑		Star	ndby Current	-1	mA	1			
	Control Status	0010	hex	•		Star	ndby Time to Empty	8040	min	$\overline{\mathbf{v}}$			
DataRAM	At Rate	0	mA	•		Max	imum Load Current	-45	mA	☑			
	At Rate Time To Empty	65535	min			Max	Load Time to Empty	179	min	☑			
	Temperature	19.7	degC	\mathbf{V}	$\overline{\mathbf{v}}$	Ava	ilable Energy	485	mWh	▼			
	Voltage	3760	mV	\mathbf{V}	$\overline{\mathbf{v}}$	Ave	rage Power	0	mW	\mathbf{V}			
Data	Flags	0100	hex		$\overline{\mathbf{v}}$	Tim	e to Empty Const Power	65535	min	$\overline{\mathbf{v}}$			
Elask	NomAvailCap	134	mAh		$\overline{\mathbf{v}}$	Inte	rnal Temperature	19.5	degC	\mathbf{V}			
Flash	Full Available Capacity	433	mAh			Cyc	le Count	0	-	$\overline{\mathbf{v}}$			
	Remaining Capacity	134	mAh	V	\mathbf{V}	Stat	te of Charge	31	%	$\overline{\mathbf{v}}$			
	Full charge Capacity	433	mAh	V	$\overline{\mathbf{v}}$	Stat	te of Health	100	-	\mathbf{V}			
T2C Pro	Average Current	0	mA			Pass	ed Charge	0	mAh	◄			
	Average Time to Empty	65535	min			DOC	0	11328	-	◄			
	Average Time to Full	65535	min		$\overline{\mathbf{v}}$	Pack	k Configuration	0131	-				
Calibrate	Flags / Status Bits Control Status - SCANN SE FAS SHUTDWN HIBERNATE	IING SS FULLSLEE	:P	CSV		CCA	BCA TSM RUP_DIS VOK	GB					
•	Elgos - SCANNTNG												
	OTC OTD	RSVD		MTL	СН	6_INH	XCHG FC	СНБ					
100%	OCVTAKEN RSVD	LS_ST2	L	.S_STI	50	DH_LS1	50C1 50CF	DSG					
	Pack Configuration - SC												
	RESCAP RSVD	RSVD		RSVD	61	NDSEL	IWAKE RSNS1	RSNS	0				
	RSVD RFACTSTEP	SLEEP		RMFCC	S	E_PU	SE_POL SE_EN	TEMP	S				
		5	how F	lags							Show Static	<u>D</u> ata	
31%	Scan Off Device:5	41,Ver:2.0	0										
Communication OK.										SBS	Task Progress: 100%	Task Completed.	04:08:41 PM

Figure 8: Impedance Track Control Register Write in bq Evaluation Software



11. Transition to SEALED state. Click in the Control field, as shown Figure 8. It will let you type in to it. Type 0020. Press the Enter key on keyboard.

🔓 Texas Instrume	ents bq Gas Gauge Evaluat	ion Softwa	ire - bi	q2754	LV200 v2	2.00 - [SBS Data]				Transf.		- 0 <mark>- X</mark>
💰 File Option	is AutoCycle View W	indow H	elp									_ & ×
	TEXAS INSTRUME Refresh Start Logging Logg	INTS	<u>K</u> eep anning		REA	ALWORLDS	IGN	AL	Р	ROCESSI	NG	
	Name	Value	Unit	Log	ican	Name	Value	Unit	Log	Scan		
	Control	0020	hex	V	<u> </u>	Standby Current	-1	mA	V	<u> </u>		
	Control Status	0010	hex	•	V	Standby Time to Empty	19140	min	V			
DataRAM	At Rate	0	mA	•		Maximum Load Current	-45	mA	V			
Barakam	At Rate Time To Empty	65535	min	•		Max Load Time to Empty	425	min				
	Temperature	19.4	degC			Available Energy	1189	mWh				
	Voltage	3957	mV	☑		Average Power	0	mW	V			
Data	Flags	0100	hex	◄		Time to Empty Const Power	65535	min	V			
Elask	NomAvailCap	319	mAh	◄		Internal Temperature	20.3	degC	V			
Flash	Full Available Capacity	432	mAh	V		Cycle Count	0	-	V			
	Remaining Capacity	319	mAh	•		State of Charge	74	%	◄			
	Full charge Capacity	432	mAh	✓		State of Health	100	-				
T2C Pro	Average Current	0	mA	V		Passed Charge	0	mAh	◄			
120110	Average Time to Empty	65535	min	◄		DODO	4352	-	◄			
	Average Time to Full	65535	min	◄		Pack Configuration	0131	-	V			
Calibrate	Flags / Status Bits Control Status - SCANN SE FAS SHUTDWN HIBERNATE	IING 55 FULLSLEE	iP	CSV SLEEP	CC. LDN	A BCA TSM ND RUP_DIS VOK	6B QEN					
	Flags - SCANNING											
	OTC OTD	RSVD	+ .	MTL	CHG_	INH XCHG FC	CHG					
100%	Pack Configuration - 50	ANNING		.0_011	<u> 001</u>		030					
	RESCAP RSVD	RSVD		RSVD	GND	SEL IWAKE RSNS1	RSNS	0				
	RSVD RFACTSTEP	SLEEP	1	RMFCC	SE_	PU SE_POL SE_EN	TEMP	5				
Eval Gauge		5	how F	lags						Show Static	<u>D</u> ata	
74%	Scan Off Device:5	41.Ver:2.0	0									
Communication OK.	,								SBS T	ask Progress: 100%	Task Completed.	01:13:53 PM

Figure 9: Transition to SEALED state Control Register Write in bq Evaluation Software



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12. Click the Refresh button as shown in Figure 10.

b Texas Instrum	ents bq Gas Gauge Evaluati	on Softwa	ire - b	q2754	1V200	v2.00 - [SBS Data]	-	-	-			
🗳 File Option	ns AutoCycle View Wi	ndow H	elp									- 8 ×
	TEXAS INSTRUME Refresh Start Sto Logging Logg	NTS p C ing Sc	<u>K</u> eep anning	1	RЕ	AL WORLD	SIGN	AL	Р	ROCESSI	NG [™]	
	Name	Value	Unit	Log	Scan	Name	Value	Unit	Log	Scan		
	Control	0019	hex	⊽		Standby Current	-1	mA				
	Control Status	0019	hex	☑		Standby Time to Empty	8040	min				
DataRAM	At Rate	0	mA	☑		Maximum Load Current	-45	mA				
	At Rate Time To Empty	65535	min			Max Load Time to Empty	179	min		V		
	Temperature	20.0	degC	▼		Available Energy	485	mWh	V			
	Voltage	3759	mV	☑		Average Power	0	mW	V			
Data	Flags	0100	hex	◄		Time to Empty Const Powe	er 65535	min	\mathbf{V}			
Elask	NomAvailCap	134	mAh	◄		Internal Temperature	19.7	degC				
Flash	Full Available Capacity	433	mAh	◄	\mathbf{V}	Cycle Count	0	-				
	Remaining Capacity	134	mAh	◄		State of Charge	31	%	\mathbf{V}	V		
	Full charge Capacity	433	mAh	◄		State of Health	100	-				
T2C Pro	Average Current	0	mA	◄		Passed Charge	0	mAh				
	Average Time to Empty	65535	min			DODO	11328	-				
	Average Time to Full	65535	min			Pack Configuration	0131	-				
Calibrate	Flags / Status Bits Control Status - SCANN SE FAS SHUTDWN HIBERNATE Flags - SCANNING	ING SS FULLSLEE	P	CSV SLEEP		CCA BCA TSM DMD RUP_DIS VOK	GB QEN	a la				
	OTC OTD	RSVD		MTL	CHO	G_INH XCHG FC	CHG	;				
100%	OCVTAKEN RSVD	LS_ST2	L	.S_STI	50	H_LSI SOCI SOCF	DSe	;				
	Pack Configuration - SC RESCAP RSVD			RSVD	GN	NDSEL IWAKE RSNS1	RSNS	i0				
	RSVD RFACTSTEP	SLEEP		KMPCC	5	e_FU SE_FUL SE_EN	TEMP	0				
0%		6	how F	lags						Show Static I	Data	
31%	Scan Off Device:54	41,Ver:2.0	0								_	
Communication OK									SBS	Task Progress: 100%	Task Completed.	04:10:31 PM

Figure 10: Refresh in bq Evaluation Software



13. Verify that the QEN bit, FAS bit and SS bit in the Control Status register is set (red) as shown in Figure 11.

م ۲exas Instrum	ents bq Gas Gauge Evaluati	on Softwa	are - b	q2754:	V200	v2.00 - [SBS Data]						_ 0 <mark>_ X _</mark>
🔅 File Options AutoCycle View Window Help												
	TEXAS INSTRUME Refresh Start Logging Stor	NTS p C ing Sc	<u>K</u> eep anning		RE	ALWORLDS	IGN	A L	Р	ROCESS	ING [™]	
	Name	Value	Unit	Log	ican	Name	Value	Unit	Log	Scan		
	Control	601B	hex	▼	₹	Standby Current	-1	mA				
	Control Status	601B	hex	V		Standby Time to Empty	19140	min				
DataRAM	At Rate	0	mA	V		Maximum Load Current	-45	mA				
	At Rate Time To Empty	65535	min	V		Max Load Time to Empty	424	min	☑			
	Temperature	19.4	degC	V		Available Energy	1186	mWh				
	Voltage	3957	mV			Average Power	0	mW	▼			
Data	Flags	0100	hex			Time to Empty Const Power	65535	min				
Elach	NomAvailCap	319	mAh	◄		Internal Temperature	20.3	degC	▼			
Flash	Full Available Capacity	432	mAh	◄		Cycle Count	0	-	◄			
	Remaining Capacity	318	mAh	◄		State of Charge	74	%	▼			
	Full charge Capacity	431	mAh			State of Health	100	-				
T2C Pro	Average Current	0	mA			Passed Charge	0	mAh				
	Average Time to Empty	65535	min			DOD0	4368	-				
	Average Time to Full	65535	min			Pack Configuration	0131	-				
	Flags / Status Bits Control Status - SCANN SE FAS SHUTDWN PEDENATE Flags - SCANNING OTC OTD OCVTAKEN RSVD Pack Configuration - SC	ING SS PULLCLET RSVD L5_ST2 ANNING		CSV SLEEP MTL .5_ST1	CH SC	CCA BCA TSM LDMD RUP_DIS VOK (IG_INH XCH6 FC DH_LSI SOCI SOCF	CH6 DS6					
0% Fuel Gauge 74%	RSVD RFACTSTEP	SLEEP 5 41,Ver:2.0	Show F	RMFCC Flags	S	E_PU SE_POL SE_EN	TEMP	5	cnc 1	Show Static	<u>D</u> ata	01.15.20 DV
Communication UK	he								2821	ask Progress: 100%	rask Completed.	01:15:36 PM

Figure 11: QEN, FAS and SS Bits Set in bq Evaluation Software



14. Enable Hibernate Mode. Click in the Control field, as shown Figure 8. It will let you type in to it. Type 0011. Press the Enter key on keyboard.

4 Texas Instrum	ents bq Gas Gauge Evaluati	ion Softwa	are - be	q2754	LV200 v2	2.00 - [SBS Data]		-	-				
File Option	ns AutoCycle View Wi	indow H	elp										_ 8 ×
	TEXAS INSTRUME Refresh Start Logging Logg	ENTS	<u>K</u> eep anning		RE	ALWOR	LDS	IGN	AL	Р	ROCESS	ING [™]	
	Name	Value	Unit	Log	ican	Name		Value	Unit	Log	Scan		
^	Control	0011	hex	1	v	Standby Currer	nt	-1	mA	1	<u>v</u>		
	Control Status	601B	hex	V		Standby Time t	o Empty	19140	min	•	V		
DataRAM	At Rate	0	mA	V		Maximum Load	Current	-45	mA	~	V		
Barak/im	At Rate Time To Empty	65535	min	V	▼	Max Load Time	to Empty	424	min	•	V		
	Temperature	19.4	degC	•	₹	Available Ener	9Y	1186	mWh	•	V		
	Voltage	3957	mV	•	₹	Average Power		0	mW	•	V		
Data	Flags	0100	hex			Time to Empty	Const Power	65535	min	•			
	NomAvailCap	319	mAh			Internal Tempe	rature	20.3	degC				
Flash	Full Available Capacity	432	mAh			Cycle Count		0	-	•	V		
	Remaining Capacity	318	mAh			State of Charg	e	74	%	~			
	Full charge Capacity	431	mAh	V		State of Health	ı	100	-	$\overline{\mathbf{v}}$			
T2C Pro	Average Current	0	mA	V		Passed Charge		0	mAh	$\overline{\mathbf{v}}$			
120110	Average Time to Empty	65535	min	V		DOD0		4368	-	◄			
	Average Time to Full	65535	min	◄		Pack Configure	ation	0131	-	◄			
Calibrate	Flags / Status Bits Control Status - SCANN SE FAS	IING SS	=P	CSV		A BCA	TSM VOK	GB					
-	Flags - SCANNING							-					
	OTC OTD	RSVD		MTL	CHG	INH XCHS	FC	СНБ					
100%	OCVTAKEN RSVD	LS_ST2	L	.S_ST1	SOH.	_LS1SOC1	SOCF	DSG					
	Pack Configuration - SC												
	RESCAP RSVD	RSVD		RSVD	GND	SEL IWAKE	RSN51	RSNS	0				
	RSVD RFACTSTEP	SLEEP	-	RMFCC	SE_	PU SE_POL	SE_EN	TEMP	5				
0%	_	how F	lags						Show Stati	ic Data			
74% Scan Off Device:541 Ver:2 00											_		
Communication OK.		,								SBS	Task Progress: 100%	Task Completed.	01:16:28 PM

Figure 12: Hibernate Mode Control Register Write in bq Evaluation Software



15. Verify that the HIBERNATE in the Control Status register is set (red) as shown in Figure 11.

🖕 Texas Instruments bq Gas Gauge Evaluation Software - bq27541V200 v2.00 - [SBS Data]													
🔏 File Options AutoCycle View Window Help													
Image: Start Logging Stop Logging Keep Scanning Graphs													
	Name	Value	Unit	Log	Scan	Name		Value	Unit	Log	Scan		
-	Control	0000	hex	☑		Standby (Current	-1	mA	•	V		
	Control Status	605B	hex	~		Standby -	Fime to Empty	19140	min	☑			
DataRAM	At Rate	0	mA	~		Maximum	Load Current	-45	mA	☑			
	At Rate Time To Empty	65535	min	•		Max Load	Time to Empty	424	min	◄			
	Temperature	19.4	degC	◄		Available	Energy	1186	mWh	▼			
	Voltage	3957	mV	☑		Average	0	mW	▼				
Data	Flags	0100	hex	✓		Time to E	mpty Const Power	65535	min	◄			
Elask	NomAvailCap	319	mAh	✓		Internal ⁻	Femperature	20.3	degC	◄			
Fidsh	Full Available Capacity	432	mAh	•		Cycle Count		0	-	◄			
	Remaining Capacity	318	mAh	◄		State of (Charge	74	%	◄			
	Full charge Capacity	431	mAh	◄		State of Health		100	-	◄			
T2C Pro	Average Current	0	mA			Passed Ch	large	0	mAh				
	Average Time to Empty	65535	min			DOD0		4368	- 🛛				
	Average Time to Full	65535	min			Pack Con	figuration	0131	-				
Calibrate	Flags / Status Bits Control Status - SCANN SE FAS SHUTDWN HIBERNATE Flags - SCANNING OTC OTD		EP	CSV SLEEP MTL	L CH	CCA BO DMD RUP 6_INH XC	CA TSM DIS VOK HG FC	GB QEN CHG					
100%	OCVTAKEN RSVD	LS_ST2	- L	.S_ST1	SO	H_LS1 SO	CI SOCF	DSG					
	Pack Configuration - SC RESCAP RSVD RSVD RFACTSTEP	ANNING RSVD SLEEP		RSVD	61 S	NDSEL IW	AKE RSNS1 POL SE_EN	RSNS TEMP	0 5				
0%	Show Flags Show Static Data											: <u>D</u> ata	
74%	Scan Off Device:54	41,Ver:2.0	0										
Communication OK	·									SBS	Task Progress: 100%	Task Completed.	01:16:55 PM

Figure 13: QEN Bit Set in bq Evaluation Software

16. Remove the Janus battery from the Texas Instruments EV2300 USB to I2C converter.